MAR 31 1917
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Engineering News

Volume 77, No. 13
Issued Every Thursday
McGraw-Hill Publishing Co., Inc.

NEW YORK, MARCH 29, 1917

Price, 15 Cents
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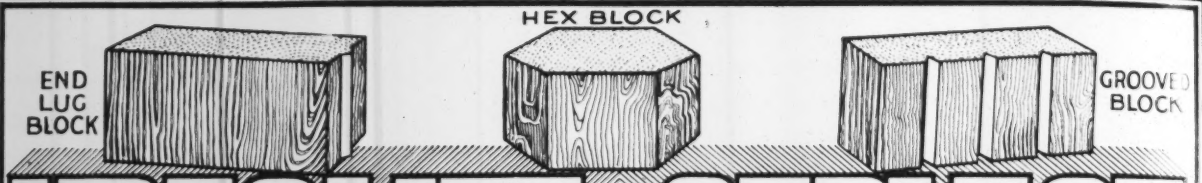

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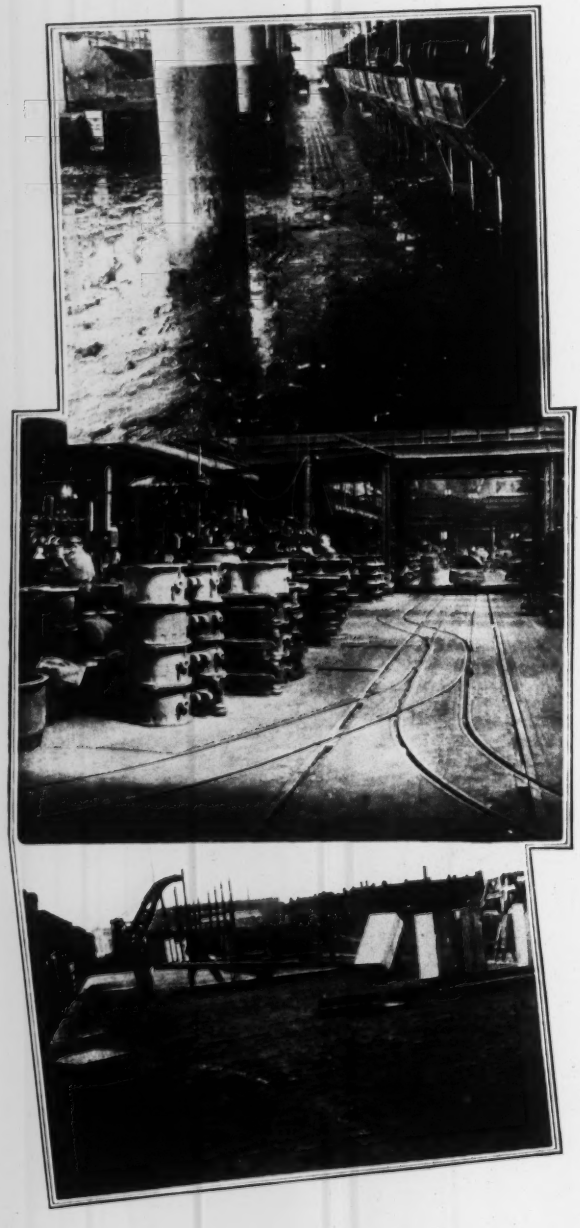

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The middle view shows the Kreolite Side Groove Wood Block in the machine shop of the Westinghouse Air Brake Co. Note the heavy sharp-edged castings handled over this floor. Both a plank and concrete floor were tried out unsuccessfully before the Kreolite floor was installed.

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Engineering News

VOLUME 77 MARCH 29, 1917 NUMBER 13

Arcaded Cantilevers Cased in Concrete Feature a Million-Dollar Bridge

SYNOPSIS—Hanover St. bridge, in Baltimore, looks like a succession of concrete arches but in reality consists of steel and concrete cantilevers.

Replacing the old wood trestle and steel swing bridge across the Patapsco River at Light St. in southern Baltimore, a concrete "arch" bridge just completed forms a new thoroughfare across the estuaries of Patapsco River and Middle Branch. The consulting engineer, J. E. Greiner, was given the task of designing a bridge of graceful or even monumental appearance and of permanent type, which appeared to mean a reinforced-concrete arch bridge. However, as in his judgment it was impracticable to found an arch bridge in the soft mud bottom, he devised a cantilever design, as shown by the drawings herewith.

Cantilever construction to secure a concrete-arch effect has been used before in two or three cases, as cited in *Engineering News* of Mar. 25, 1915 (p. 579), and Apr. 22, 1915 (p. 790). The 100-ft. span of the Deer Creek bridge at Husbands Ford, Md. (L. F. Smith), and the 95-ft. span of the Chester Creek arch at Fifth St., Chester, Penn. (H. H. Quimby), are the most important of these. They are single-span structures, however. The Hanover St. bridge comprises a whole series of spans, each equal to the single span of the Deer Creek and Chester bridges, and totaling 2280 ft. It is thus the most prominent application of the reinforced-concrete cantilever principle to date. The finished bridge, as built under charge of H. G. Shirley, Chief Engineer of the State Roads Commission of Maryland, and Mr. Greiner as Consulting Engineer, is accurately portrayed by the two bird's-eye views in Fig. 1, reproduced from drawings by E. W. Spofford. They show typically the arch-like appearance secured. If a view like Fig. 3 is studied, however, the joint in the arch crown shows the separation between the ends of the adjacent cantilevers.

FIG. 1. BIRD'S-EYE VIEWS OF HANOVER ST. BRIDGE, LOOKING NORTH

The location (see sketch in Fig. 4) lies west of the Light St. bridge and traverses the point of the peninsula between the two estuaries. The north crossing is the main one; it consists of spans of the arch-cantilever type, all of them 95-ft. in the clear, and a 150-ft. Rall two-leaf bascule. The south crossing is mostly earth fill, but it has two concrete column-and-girder openings, 512 ft. and 105 ft. wide respectively. The smaller one, seven 15-ft. spans, has ordinary reinforced-concrete girders. The larger contains 16 spans of 30 ft. and one of 32, and here, to save falsework, the reinforcement was made of structural steel frames designed strong enough to carry the forms and the rib concrete (but not the floor slab).

In both crossings the soil was mud to depths of 70 to 100 ft. Foundation on piles was adopted. Some doubt as to the bearing power of the piles was caused by the presence of a hard stratum below El. —70, under which was a further 10- to 15-ft. layer of mud. The final decision was to drive until the penetration did not exceed ½ in. per blow in the last five blows of a 3000-lb. hammer falling 15 ft. In general, this meant that the piles stopped in the upper hard layer. The profile in Fig. 4, plotted by R. G. Browning, Resident Engineer, represents the piling as actually put in. The piles range from 65 to 85 ft. long, but in the north approach many 100-ft. piles were driven.

The adopted pile loading is 16 tons. With regard for the possible vibration effects from the bascule, however, longer piles were ordered for the north bascule pier and an extra price was paid to drive beyond the specified resistance. On the other hand, occasional piles in the footings of the northerly half of the structure are under the specifications. Throughout, the driving resistance varied greatly, probably because of lumps of iron ore in the ground.

That the soil conditions are unfavorable to piers carrying horizontal arch thrust became quite evident when the fills of the north approach and of the south crossing were made. Extensive flow of the subsoil developed at the south crossing, the soil being upheaved on either side (Fig. 11) in banks up to 150 ft. wide and 8 to 10 ft. high, where previously there had been 3 to 5 ft. of water.

While the north approach fill of the north crossing was being made, outward displacement of a few column footings occurred due to pressure or flow of the fill. This called for some troublesome repair work. At least one of the footings also underwent abnormal settlement, thought to be chargeable to flow of the mud stratum underlying the first hard crust.

The pier bases are at El. —25, except for the bascule piers, which extend to 10 ft. deeper. They were built in open cofferdams, no special difficulty being encountered. The unusual shape of the piers—shaft of ribbed cross-section on a reinforced bottom slab—deserves notice (Fig. 6).

The Steel-Rib Cantilevers

The "arch" design was practically dictated as to span and intrados outline by the Government's navigation requirement, calling for 26½-ft. clearance height above mean low water on a width of 70 ft. in each span. Spans of 95 ft. with approximately elliptical intrados suited this clearance diagram.

The cantilever rib and its steel cantilever skeleton and backstays are both shown in Fig. 5. The backstays

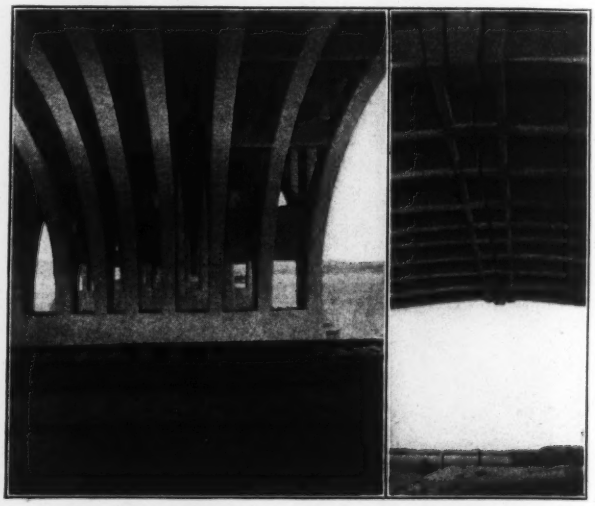


FIG. 2. VIEW UNDER A LAND ARCH BRIDGE

FIG. 3. VIEW SHOWING CROWN JOINT

take full-load tension, but the live-load rib compression is divided between steel and concrete. There are ten ribs, braced in pairs by occasional struts of concrete-incased steel girder makeup. Two steel ribs of adjoining spans, back to back, with anchorage tower between, and their eyebar backstays, were designed to be a unit and were so built. The steel weight, thus, was to be kept balanced at all times. However, the anchorage was proportioned on a more liberal basis, to insure safety under all conditions. The anchor bolts holding the steel tower to the pier were designed for the unbalanced weight of steel and concrete-forms of one cantilever half-span, and for the alternative

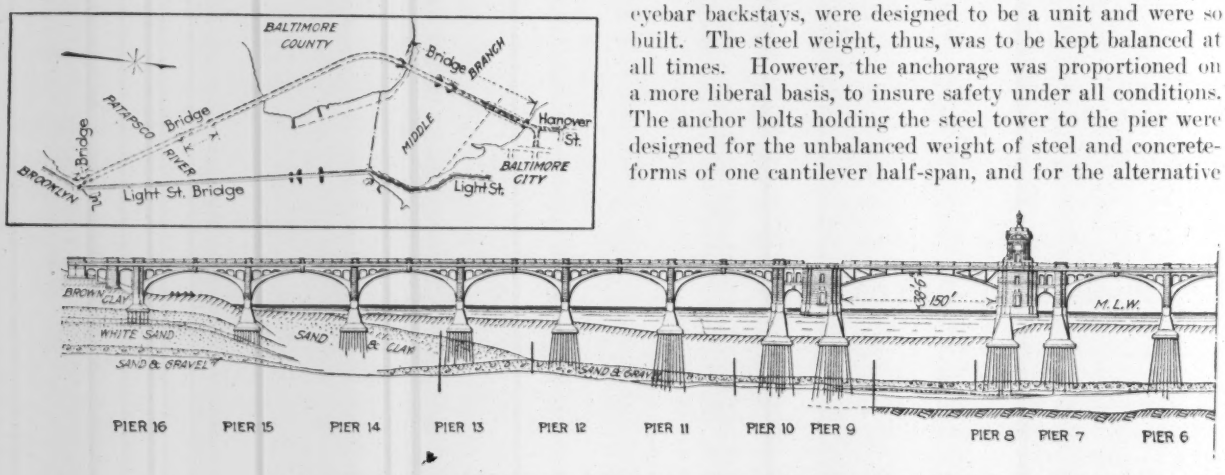


FIG. 4. GENERAL LAYOUT OF HANOVER ST. BRIDGE OVER THE PATAPSCO RIVER AT

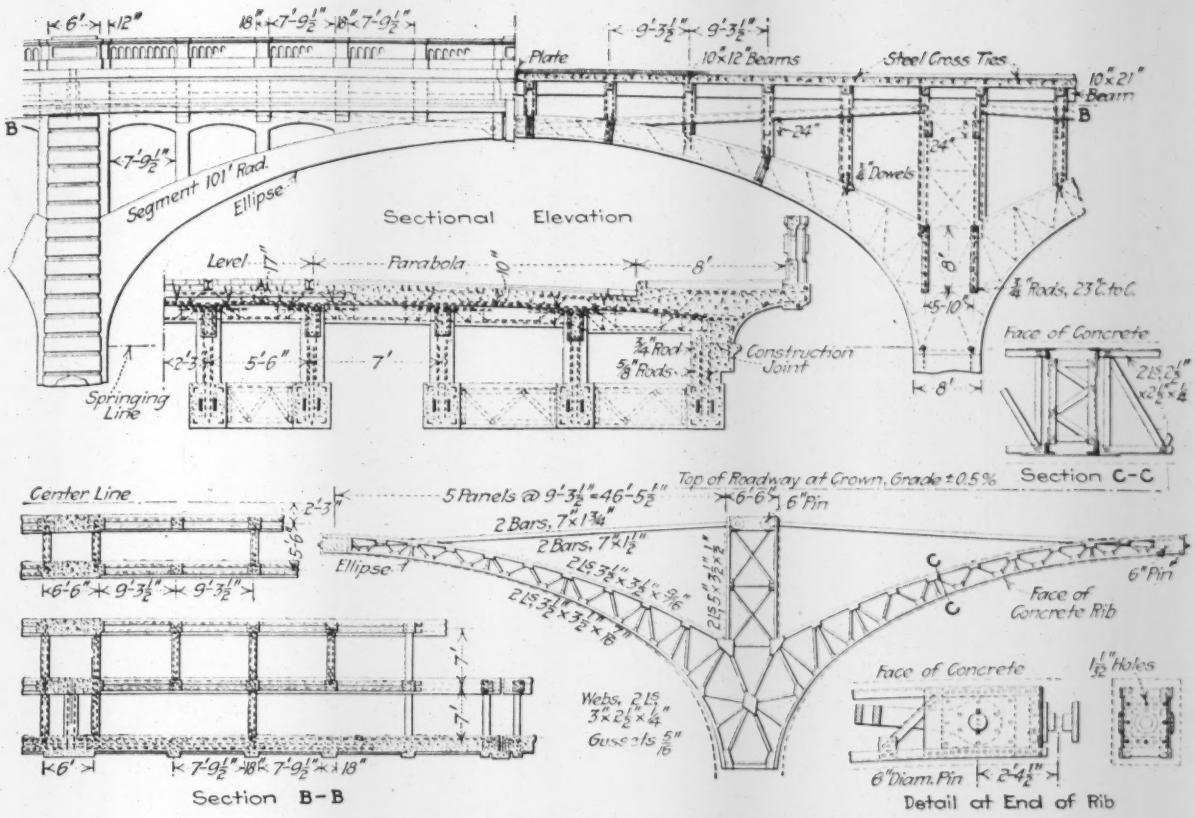


FIG. 5. TYPICAL CANTILEVER ARCH OF HANOVER ST., NORTH CROSSING

condition of balanced steelwork and forms but unbalanced concrete of one-half span. The contractor actually did the work in balanced condition.

Each span is completely cut at the crown, so far as the concrete is concerned. The gap is 3 in. wide. The steel ribs also are kept far enough apart to prevent any butting contact as a result of deflection or settlement, but they are connected by a longitudinal pin which serves as shear tongue, compelling the adjoining ends to deflect equally.

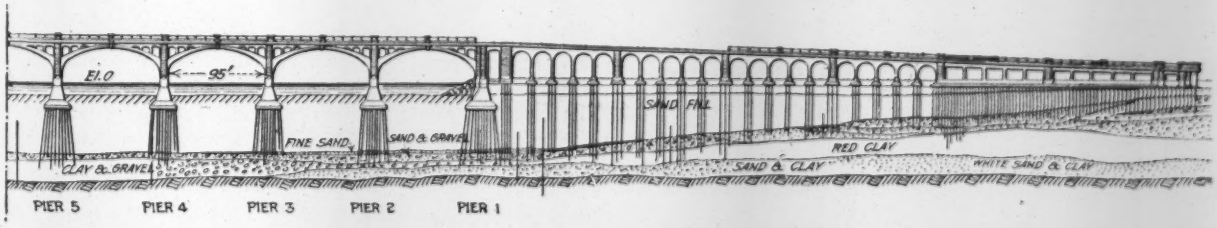
The open spandrels above the ribs were adopted for good appearance as much as for lightness. The roadway, slab and girder work is simple and follows normal practice. For designing the coping and balustrades and the prominent operators' houses at the end of the bascule, the critical coöperation of W. W. Emmert, of the firm of Ellicott & Emmert, architects, Baltimore, was secured.

The steel skeleton work is designed for a tension of 16,000 lb. per sq.in. and a compression of $nf_c = 15 \times 650$ or 9750 lb. per sq.in. Under the most unfavorable live-load the rib flanges are subjected to slight tensile stress in some portions.

Not only were the steel ribs erected as double cantilevers but the whole superstructure concreting was also carried out in these individual umbrella units, without any necessary relation between the two halves of an "arch" except as convenience of work might dictate. The small photographs, Figs. 10 and 11, show such umbrellas.

The steel skeleton of one rib for the whole length of an umbrella, consisting of two half ribs, the anchor tower on the pier, and two backstays, was assembled at the structural shop (Maryland Steel plant at Sparrows Point), forming an erection piece 105 ft. long. It was transported by scow to the bridge site, and there lifted off and set directly to place on the pier. In this setting the deflection of the steel under the weight of the rib concrete (nearly 3 in.) was taken account of. Although the ribs were built with a camber of several inches, in placing them on the piers their tower bases were set 3 in. high to allow further for the deflection of the ends.

Concrete forms were suspended from the steel ribs, after all the ribs of an umbrella had been erected. The ten ribs were then concreted simultaneously. Columns and floorbeams, and the roadway slab, followed.



BALTIMORE AND PROFILE OF SUBSOIL AND BRIDGE FOR THE NORTH CROSSING

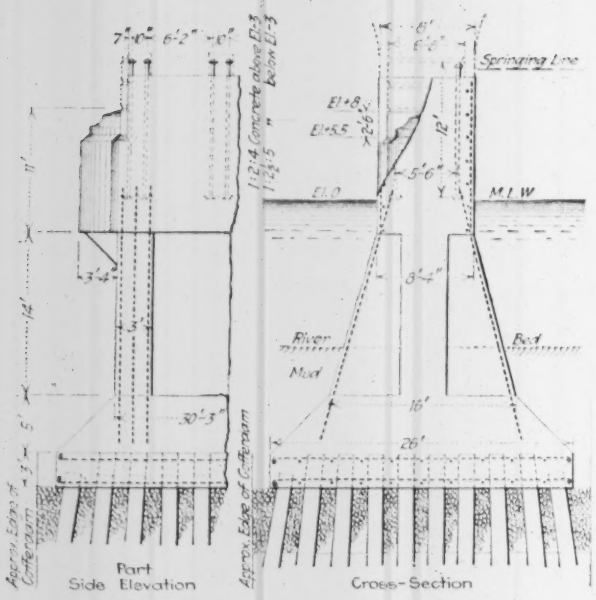


FIG. 6. TYPICAL PIER

A 3-in. opening was left between abutting units at the crown of each arch, in the roadway width; on the sidewalk and in the balustrade the joint width was reduced to 1 in. The wide slot was covered with a steel expansion plate, but the joint in sidewalk and balustrade was made by a thick strip of asphalted felt placed against the face of the section first poured.

The showing faces of the concrete were generally rubbed with carborundum and washed with neat cement wash, but panels of the rib faces and piers were heavily bush-hammered to expose the stone. The surface secured is very uniform and pleasing.

In spring of 1916, soon after the northerly span of the bridge had been concreted, its north pier was found to be something over an inch out of line. The floor slab was not yet placed. The movement was at first chiefly a shifting or tipping forward, so that the shear ribs in the end of the one cantilever touched the bottom of the socket. The further shift of the pier was in upstream direction, and slowly increased to 6½ in. It was believed to be caused by creep of the fill which had been deposited back of (and partly around) the pier to include the foundation piles of the approach column footings. Flow of this fill had been noticed previously, a short distance to the north.

Dumping riprap along the upstream end of the pier was resorted to, as a means of checking the shift. After a large amount had been put in, measurements showed the pier to have been brought back a slight amount. A total of some 3000 cu.yd. of riprap was dumped, the final result being that the pier is only 5½ in. off line (and slightly forward or south of its original position).

The movement of the pier swung the cantilever which it carries, and this, because of the pin interlock, swung

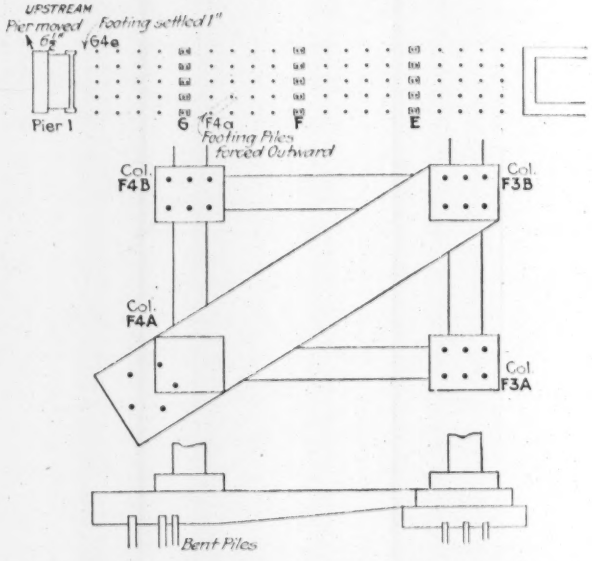


FIG. 8. SKETCH OF RECONSTRUCTED ARCADE COLUMN FOOTING

the next cantilever slightly out of line. However, the floor and balustrade were not yet in place. After the pier was under control, the forms for floor and balustrade and for the curtain wall back of the north pier were built to true line (that is, without regard to the position of the cantilevers).

At the same end of the bridge, where the footings for the retaining-wall and columns of the approach (Fig. 7) are constructed in fill, flow of the fill disturbed several footings. Delay in bringing in the fill led to the start of pile-driving and footing work when only a narrow bank of fill along each side had been deposited. Subsequently, while the center of the fill was being brought to grade, it exerted outward pressure; at footing F4A (see sketch Fig. 8) it forced one of the piles outward, shearing through the 6-in. embedment in the footing concrete. The footings, being held together by reinforced-concrete ties, were not disturbed, but it was thought necessary to reconstruct the damaged one.

This footing was cut loose from its ties, the concrete cut out, and new piles driven. Before these could be capped, however, the continuing flow of the fill forced

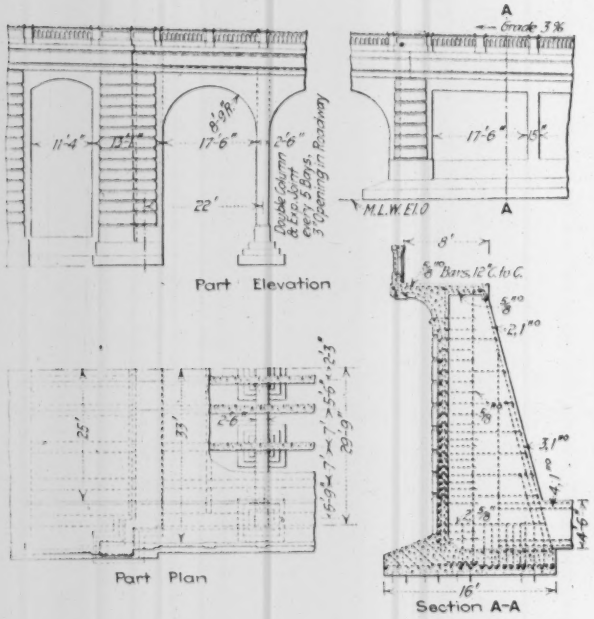


FIG. 7. RETAINING WALL AND ARCADE DETAILS, NORTH APPROACH

their tops several feet outward, so that all but two of the six piles were outside the footing area.

Rather than abandon the new piles, they were used as an offset foundation, by constructing a heavy reinforced-

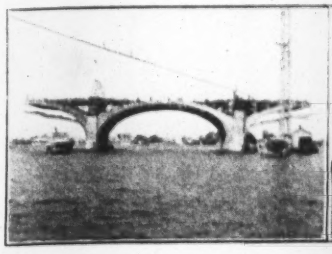


FIG. 9. TWO ADJOINING DOUBLE CANTILEVERS

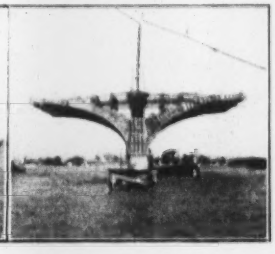


FIG. 10. CONCRETING A DOUBLE CANTILEVER

concrete girder joining them to the next footing diagonally back. This girder was connected to the ties leading to the adjacent columns. The footing then could be located on it in true position. No further movement has occurred.

Settlement of footing G4E, to the extent of about 1 in., was another bit of trouble that developed in the ap-

FIG. 11. UPHEAVED EARTH NEAR NORTHEAST CORNER OF SOUTH CROSSING.

proach. Like the other two cases, it was attributed to effect of the fill, and the engineers expect that after the initial adjustment period, there will be no further movement or pressure.

Bridge Contract at Low Prices

A prominent feature of this bridge is the fact that low unit-prices were secured. The totals are high, because of the size of the bridge. Including the road through the peninsula, which is a deep cut in hard ground, the total cost will exceed 1¼ millions. The three bridges (the north crossing and the two openings in the south crossing) cost $991,000, excluding paving. Some of the subdivisions are: Main bridge, excluding bascule and lighting, $722,000; bascule, $86,000; operating houses, $23,000; lighting, $40,000.

The concrete items include: For foundation concrete, including the cofferdam and excavation, $6.98; for 1:2:4 pier concrete, $7.32; for 1:2:4 arch and floor concrete, $11; for reinforcement, in place, $3.43 per lb.

Work began in September, 1914, and is now completed except for paving. H. P. Converse & Co. were the contractors.

Oregon May Spend Several Millions on State Highways

By Percy A. Cutter*

The Oregon legislature passed some noteworthy highway legislation during its recent session. The state took little part in roadwork until 1913, when the principal state officials were constituted a Highway Commission with power to employ an engineer. At the end of two years a change was made, and the highway work was placed in charge of the State Engineer. In January, when the legislature met again in its biennial session, precedent and political pressure carried the day for an entire change in the manner of handling highway work.

The Highway Commission provided by the new act consists of three non-salaried men appointed by the Governor. This commission is authorized to appoint an engineer to have charge of the construction work. As the office of the commission is at the Capitol and all the commissions reside elsewhere and receive no compensation for their services, the Highway Engineer will of necessity be the active executive officer of the department. A salary not to exceed $5000 (which is equal to the salary of the Governor) is provided for the engineer, and he is authorized to act independently of the commission in conferring with county road officials and furnishing plans. The Highway Commission is authorized to cooperate with the Federal Government. Funds are provided for carrying on cooperative roadwork from a license fee on automobiles, an annual one-fourth mill tax and a bond issue of not to exceed $1,800,000 during the next five years.

In addition the legislature passed an act providing for a bond issue of $6,000,000 to provide funds for hard-surfacing certain roads after the counties have provided the roadbed for the reception of the paving. These funds are not available for cooperative work with the Federal Government and may be expended only upon roads designated as hard-surface roads, post roads and forest roads. This act will be voted on by the people at a special election on June 4.

Another important change in the Oregon road laws was the abolishment of the old road-supervisor system, with its loose, extravagant and inefficient method of handling road funds and the substitution of a county roadmaster in each county acting under the direction of the County Court. This concentrates power and responsibility and makes possible the systematic expenditure of road funds and the adoption of uniform methods of construction.

State Ownership of Electric Central Stations is making rapid progress in Germany, according to a review in London "Engineering." In the kingdom of Saxony a law was enacted last spring providing for a state supply of electric energy. The Government has purchased extensive lignite mines and plans to build large electric generating stations at the mines, from which the current will be transmitted to any desired point. The Diet recently appropriated 20,000,000 M. to begin the work, which will require a total of between 100,000,000 and 200,000,000 M. The Government proposes first to take over the business of the private companies now engaged in supplying electric current, but will later on supply current to the municipally owned stations as well. It is of interest to note that in 1914 the municipal electric works in Saxony had about 150,000 kw. of machinery installed, while the electric central stations owned by private companies had about 80,000 kw. In Bavaria, also, plans have been matured for a state-owned and operated electric central plant, and the work has been approved by the Bavarian Diet.

*Assistant State Engineer, Salem, Ore.

A Safe Method Proposed for Estimating Minimum Rainfall

By James P. Wells*

SYNOPSIS—From a study of long-time rainfall records in the United States it is concluded that minimum-mean factors afford a safe basis for estimating minimum rainfall.

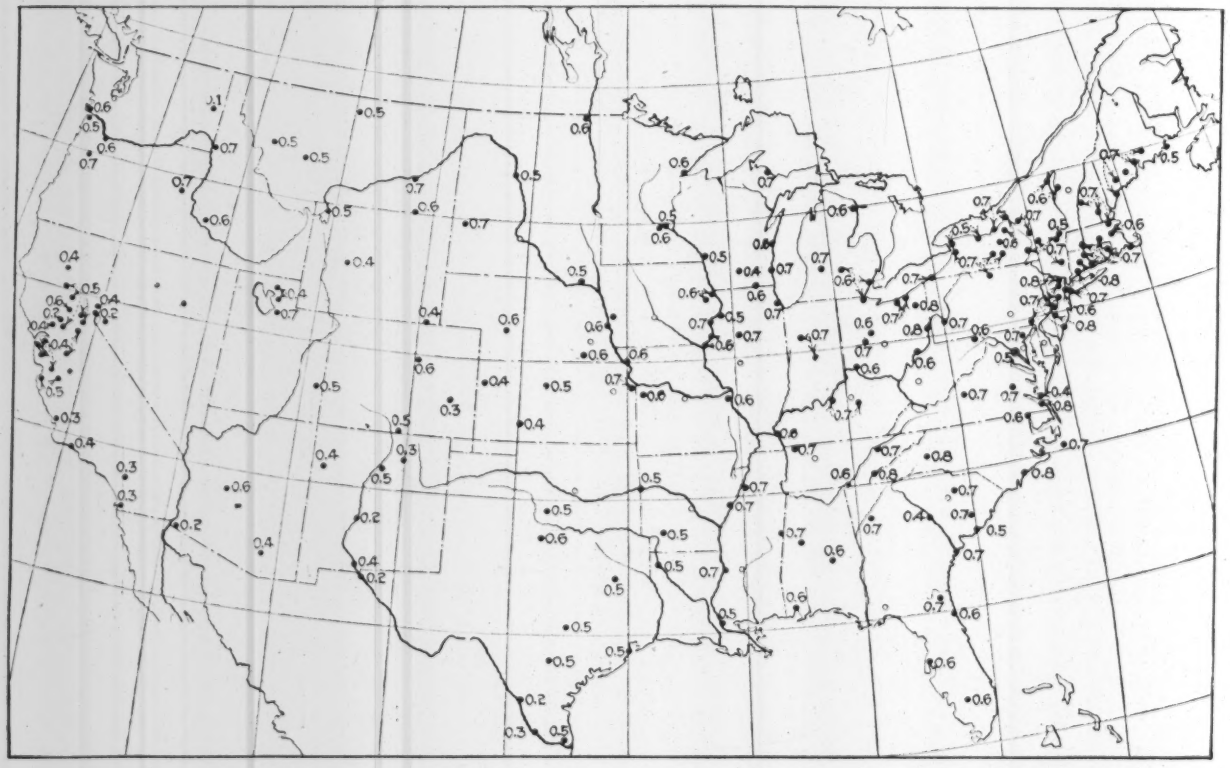
It is a matter of common knowledge among engineers engaged in hydraulic work that extreme conditions of rainfall and runoff are far more important than average conditions. Too often has it been the case that large sums of money have been invested in hydraulic projects only to find, upon the occurrence of a dry year, that there has been an insufficient supply of water, resulting in considerable financial loss. Such dry years are invariably due to low rainfall conditions. Though not following any exact formula or rule, the amount of runoff will vary with the rainfall. Few, if any, streams have records of runoff as long as records of rainfall, and it seldom happens that the stream-flow records have been kept in the year of lowest rainfall. While a forty-year rainfall record would be considered good, a complete ten-year record of stream flow would be considered exceptionally good. Also, in many districts only very short records of precipitation are available. In view of the foregoing facts, in order to conservatively estimate minimum runoff conditions, it is essential to have some safe method of determining the minimum rainfall that will occur during a long period of years.

With the idea of finding some way of safely estimating the minimum rainfall, the writer has gone over all the long records kept by the United States Weather Bureau up to 1909, as published in the climatological summaries, and has tabulated the mean, minimum and maximum annual precipitation. The relations between these records have been calculated and called maximum-minimum, maximum-mean and minimum-mean rainfall factors. From the practical viewpoint, inasmuch as minimums are of prime importance, the minimum-mean is the most useful and important of these factors.

Minimum-Mean Factor for Different Regions

On the accompanying map the minimum-mean rainfall factor has been plotted for a great number of stations throughout the country. An examination of this map shows several important facts in regard to the variations in this factor for different localities. In the eastern half of the country there is a marked tendency toward uniformity. East of the Mississippi River, with the exception of the State of Wisconsin, the factor for by far the greater number of stations is about 0.7 for records of 40 or 50 years. In the southwestern portion of the Mississippi valley it is about 0.5 and in the northwestern portion about 0.6. There is also a tendency toward uniformity in the northwestern Pacific Coast

*Consulting Engineer, Rochester, N. Y.



MINIMUM-MEAN RAINFALL FACTORS FOR STATIONS IN THE UNITED STATES WITH LONG RECORDS

RAINFALL FACTORS FOR UNITED STATES

Stations	Years	Mean	Max.	Min.	Max. Min.	Max. Mean	Mean Min.	Min. Mean
Maine								
Eastport	36	42.90	64.53	22.84	2.8	1.5	1.9	0.53
Portland	39	42.63	59.24	30.74	1.9	1.4	1.4	0.72
Lewiston	34	45.35	58.61	32.74	1.8	1.3	1.4	0.72
Orono	37	43.18	53.74	29.03	2.4	1.4	1.5	0.67
Gardiner	65	43.06	55.47	30.19	1.8	1.3	1.4	0.71
New Hampshire								
Concord	52	39.82	54.51	26.25	2.1	1.4	1.5	0.65
Hanover	57	35.72	55.85	24.30	2.3	1.6	1.5	0.68
Vermont								
Burlington	64	32.68	49.44	20.99	2.4	1.5	1.6	0.64
Massachusetts								
Boston	91	44.70	67.72	27.20	2.5	1.6	1.7	0.60
Springfield	52	45.36	57.97	30.90	1.9	1.3	1.5	0.68
Lawrence	43	42.96	58.70	31.35	1.9	1.4	1.4	0.72
New Bedford	93	46.58	65.41	34.51	1.9	1.4	1.4	0.74
Worcester	49	45.12	61.83	32.50	1.9	1.4	1.4	0.72
Connecticut								
New Haven	57	45.89	60.26	33.89	1.8	1.3	1.4	0.73
Middleton	36	49.25	68.77	37.08	1.9	1.4	1.3	0.75
Wallingford	43	49.48	63.12	37.88	1.7	1.3	1.3	0.76
Hartford	47	44.30	55.81	33.47	1.7	1.3	1.3	0.75
Rhode Island								
Providence	77	45.31	63.50	30.51	2.1	1.4	1.5	0.67
New York								
Plattsburg	57	30.52	46.80	18.91	2.5	1.5	1.6	0.61
Albany	84	38.39	56.78	26.98	2.1	1.5	1.4	0.70
Troy	59	36.50	49.16	18.32	2.7	1.5	2.0	0.50
New York	84	42.47	59.68	28.78	2.1	1.4	1.5	0.67
West Point	48	46.37	63.56	30.64	2.1	1.4	1.5	0.60
Utica	36	42.14	65.58	33.16	2.0	1.5	1.3	0.78
Oxford	41	40.63	60.63	29.13	2.1	1.5	1.4	0.71
Cooperstown	56	40.09	58.11	29.92	2.0	1.4	1.4	0.74
Sacketts Harbor	44	32.46	55.73	21.67	2.6	1.7	1.6	0.64
Lowville	43	36.48	48.61	26.47	1.8	1.3	1.4	0.72
Penn Yan	60	28.99	44.36	19.66	2.2	1.5	1.5	0.67
Palermo	53	37.01	54.17	24.19	2.3	1.5	1.5	0.65
Oswego	54	36.92	56.16	25.93	2.1	1.5	1.4	0.70
Ithaca	48	32.97	46.39	21.20	2.2	1.4	1.5	0.66
Auburn	41	36.47	49.82	21.74	2.3	1.4	1.7	0.59
Rochester	80	33.34	49.89	17.04	2.9	1.5	2.0	0.51
Fort Niagara	37	27.52	50.49	16.44	3.1	1.8	1.7	0.50
Buffalo	53	37.19	60.24	27.27	2.2	1.6	1.4	0.73
Pennsylvania								
Erie	35	38.15	55.04	26.72	2.1	1.3	1.4	0.70
Pittsburgh	61	36.17	50.61	25.73	2.0	1.4	1.4	0.71
Wellsboro	34	46.08	85.07	31.79	2.7	1.8	1.4	0.69
Morrisville	54	43.34	57.00	30.34	1.9	1.3	1.4	0.70
Philadelphia	38	40.88	51.87	31.03	1.7	1.3	1.3	0.75
West Chester	48	49.86	73.00	33.03	2.2	1.5	1.5	0.66
New Jersey								
Paterson	36	52.20	85.99	41.42	2.1	1.6	1.3	0.79
South Orange	38	48.31	86.81	35.62	2.3	1.6	1.4	0.73
New Brunswick	55	47.84	61.30	33.35	1.8	1.4	1.4	0.69
Atlantic City	35	40.92	61.11	28.13	2.2	1.5	1.5	0.68
Newark	65	47.75	69.10	31.47	2.2	1.4	1.5	0.65
Moorestown	45	45.89	65.21	35.90	1.8	1.4	1.3	0.78
Rancocas	45	47.73	61.72	32.61	1.9	1.3	1.5	0.68
Maryland								
Baltimore	39	43.06	62.35	31.57	2.0	1.5	1.4	0.73
Fallston	39	47.66	70.17	38.06	1.8	1.5	1.3	0.79
Cumberland	37	33.85	52.42	19.96	2.6	1.5	1.5	0.58
District of Columbia								
Washington	72	40.80	61.33	18.79	3.3	1.5	2.2	0.46
West Virginia								
Morgantown	32	44.88	69.54	28.15	2.5	1.5	1.6	0.62
Wytheville	36	40.90	62.65	24.38	2.6	1.5	1.7	0.59
Virginia								
Lexington	36	41.10	60.04	30.46	2.0	1.5	1.4	0.74
Richmond	36	42.99	72.09	27.65	2.6	1.7	1.6	0.64
Fort Monroe	52	42.60	74.11	19.32	3.9	1.7	2.2	0.45
Norfolk	38	49.29	70.72	38.08	1.9	1.4	1.3	0.79
North Carolina								
Weldon	36	47.22	59.58	30.18	2.0	1.3	1.6	0.63
Hatteras	34	60.21	102.04	40.13	2.5	1.7	1.5	0.66
Wilmington	38	50.88	86.65	40.42	2.1	1.6	1.3	0.79
Lenox	34	51.78	64.00	41.39	1.5	1.2	1.3	0.79
South Carolina								
Camden	42	44.18	58.65	30.37	1.9	1.3	1.5	0.68
Pinopolis	42	49.14	65.88	33.49	2.0	1.3	1.5	0.68
Charlestown	115	48.59	78.42	23.69	3.3	1.6	2.1	0.48
Georgia								
Rome	50	47.32	68.56	31.50	2.2	1.5	1.5	0.66
Augusta	40	46.94	57.19	19.13	3.0	1.2	2.5	0.40
Savannah	60	50.06	73.36	33.50	2.2	1.5	1.5	0.66
Florida								
Jacksonville	51	52.53	82.00	37.88	2.2	1.6	1.4	0.72
St. Augustine	35	48.05	57.34	29.01	2.3	1.4	1.7	0.60
Tampa	40	51.49	89.86	32.25	2.8	1.8	1.6	0.64
Fort Myers	39	51.98	82.64	33.60	2.5	1.7	1.6	0.64
Alabama								
Mobile	37	61.80	91.18	39.50	2.3	1.5	1.6	0.63
Montgomery	36	51.16	69.85	37.00	1.9	1.4	1.4	0.72
Greensboro	35	49.86	68.98	35.67	1.9	1.4	1.4	0.71
Mississippi								
Vicksburg	54	59.07	84.22	37.21	2.3	1.6	1.4	0.71
Columbus	38	54.38	74.44	35.97	2.1	1.4	1.5	0.66
Tennessee								
Memphis	37	50.25	73.50	35.00	2.1	1.5	1.4	0.70
Murphy	28	59.67	84.80	45.64	1.9	1.4	1.3	0.77
Chattanooga	30	50.07	57.97	32.68	2.1	1.4	1.5	0.65
Knoxville	39	48.35	73.87	35.09	2.1	1.5	1.4	0.73
Clarkville	41	47.66	59.98	33.89	1.8	1.3	1.5	0.73
Kentucky								
Lexington	39	43.99	61.36	28.72	2.1	1.4	1.5	0.71
Louisville	36	44.04	56.50	29.25	1.9	1.4	1.5	0.66
Cairo	37	41.55	61.58	26.52	2.3	1.5	1.6	0.66
Ohio								
Cincinnati	74	40.91	65.18	17.99	3.8	1.6	2.1	0.43
Jacksonburg	39	39.19	50.95	22.65	2.3	1.3	1.8	0.57
Urbana	39	38.52	58.84	26.73	2.2	1.5	1.5	0.69
North Lewisburg	57	40.08	58.35	23.05	2.5	1.5	1.8	0.57
Portsmouth	76	40.50	57.59	24.30	2.4	1.4	1.8	0.60
Westerville	45	36.92	53.06	29.95	1.8	1.4	1.2	0.81
Marietta	87	42.20	61.84	26.00	2.4	1.5	1.7	0.61

RAINFALL FACTORS FOR UNITED STATES—Continued

Stations	Years	Mean	Max	Min	Max. Min.	Max. Mean	Mean Min.	Min. Mean
Steubenville	39	41.15	57.78	28.02	2.0	1.4	1.5	0.68
Cleveland	38	34.90	47.82	24.54	1.9	1.4	1.4	0.70
Hudson	37	37.29	59.17	28.80	2.0	1.6	1.3	0.79
Sandusky	40	32.97	46.31	24.89	1.9	1.4	1.3	0.75
Toledo	47	32.57	45.91	21.34	2.1	1.4	1.5	0.63
Wauseon	35	37.31	52.55	28.49	1.9	1.4	1.3	0.76
Michigan								
Alpena	36	32.79	45.61	21.59	2.1	1.4	1.5	0.65
Detroit	38	32.06	47.68	21.06	2.3	1.5	1.5	0.65
Lansing	45	30.99	48.36	19.30	2.5	1.6	1.6	0.62
Grand Rapids	34	34.85	52.14	26.18	2.1	1.5	1.5	0.62
Marquette	37	32.42	42.91	25.35	1.7	1.3	1.3	0.78
Grand Haven	35	33.78	47.89	24.02	1.8	1.4	1.4	0.71
Escanaba	34	31.14	43.83	22.21	2.0	1.4	1.4	0.71
Indiana								
Lafayette	29	38.29	46.18	27.07	1.7	1.2	1.4	0.70
Indianapolis	37	41.09	57.65	30.33	1.9	1.4	1.4	0.73
Illinois								
Cairo	37	41.61	61.58	26.52	2.3	1.5	1.6	0.63
Peoria	53	34.75	53.26	24.62	2.2	1.5	1.4	0.70
Davenport	37	32.63	46.82	17.33	2.7	1.4	1.9	0.53
Chicago	38	33.54	45.86	24.52	1.9	1.4	1.4	0.73
Wisconsin								
Beloit	42	32.71	46.64	18.86	2.5	1.4	1.7	0.59
Madison	41	31.25	52.91	13.49	3.9	1.7	2.3	0.43
Milwaukee	39	31.19	50.36	18.69	2.7	1.6	1.7	0.59
Manitowoc	47	30.18	40.51	20.16	2.0	1.3	1.5	0.66
La Crosse	37	31.31	44.74	17.37	2.6	1.3	1.8	0.55
Minnesota								
Duluth	38	29.82	45.28	19.70	2.3	1.5	1.7	0.58
St. Paul	72	27.80	49.69	14.86	3.3	1.8	1.9	0.53
Minneapolis	47	29.35	41.64	18.36	2.3	1.4	1.6	0.62
Red Wing	24	30.19	38.74	18.98	2.0	1.3	1.6	0.62
Morris	23	23.51	33.03	16.24	2.0	1.4	1.4	0.69
Iowa								
Keokuk	37	34.98	51.65	22.51	2.3	1.5	1.6	0.64
Dubuque	53	33.49	55.15	19.35	2.8	1.6	1.7	0.57
Monticello	51	34.89	52.30	18.57	2.8	1.5	1.9	0.53
Clinton	40	36.25	52.86	22.97	2.4	1.5	1.6	0.61
Davenport	37	32.64	46.82	17.33	2.7	1.4	1.9	0.50
Muscatine	40	37.79	49.51	28.53	1.7	1.3	1.3	0.75
Fort Madison	54	37.01	54.14	22.37	2.4	1.5	1.7	0.60
Logan	38	33.03	56.00	16.79	3.4	1.7	2.0	0.50
Missouri								
Oregon	53	36.43	50.74	23.12	2.2	1.4	1.6	0.63
St. Louis	72	40.14	68.83	23.28	2.4	1.7	1.7	0.57
Harrisonville	35	37.88	58.50	24.25	2.4	1.5	1.6	0.64
Kansas								
Independence	37	37.95	60.29	26.54	2.3	1.6	1.4	0.70
Dodge City	42	19.60	33.55	7.58	4.4	1.7	2.6	0.39
Wallace	39	16.66	34.00	7.45	4.6	2.0	2.2	0.52
Hays	51	22.89	35.40	11.80	3.0	1.5	1.9	0.52
Nebraska								
Fairburg	29	30.15	47.17	17.28	2.7	1.6	1.7	0.57
Omaha	41	30.46	48.92	17.82	2.7	1.6	1.7	0.58
North Platte	34	18.74	30.01	11.21	2.7	1.7	1.6	0.60
South Dakota								
Yankton	32	26.00	40.95	14.40	2.9	1.7	1.8	0.55
Fort Meade	28	20.06	30.37	13.25	2.8	1.8	1.5	0.66
North Dakota								
Pembina	35	20.31	33.83	11.75	2.9	1.7	1.7	0.58
Bismarck	34	17.50	30.92	11.03	2.8	1.8	1.6	0.53
Louisiana								
Baton Rouge	40	58.93	77.30	39.95	1.8	1.2	1.5	0.67
New Orleans	63	55.63	85.73	31.07	2.8	1.5	1.8	0.55
Shreveport	38	45.45	66.60	23.10	2.9	1.5	2.0	0.51
Arkansas								
Hope	41	52.71	70.40	29.20	2.4	1.3	1.9	0.55
Helena	34	54.33	80.40	36.78	2.2	1.5	1.5	0.67
Texas								
Graham	22	28.41	43.61	16.48	2.6	1.5	1.7	0.58
Austin	50	33.96	53.99	18.34	2.9	1.6	1.8	0.55
Palestine	28	42.51	59.66	23.98	2.5	1.4	1.8	0.55
Galveston	28	46.31	56.87	23.71	2.8	1.4	2.0	0.51
Brownsville	37	26.89	60.06	12.31	4.9	2.2	2.2	0.46
Fort Ringgold	35	17.46	32.37	5.28	6.1	1.9	3.3	0.27
Ft. McIntosh	36	19.75	36.38	4.31	8.4	1.8	4.5	0.22
San Antonio	36	27.95	41.91	14.92	2.8	1.5	2.0	0.50
El Paso	40	9.66	21.81	2.22	9.8	2.4	4.0	0.25
Montana								
Miles City	31	12.75	22.75	9.07	2.5	1.8	1.4	0.71
Helena	27	13.21	19.63	6.71	2.9	1.5	2.0	0.50
Missoula	26	15.84	22.43	8.76	2.6	1.4	1.8	0.55
Havre	30	13.63	25.67	6.76	3.9	1.9	2.0	0.49
Glendive	18	15.48	22.71	9.90	2.3	1.5	1.6	0.63
Wyoming								
Yellowstone Park	21	18.80	28.43	8.85	3.2	1.5	2.2	0.46
Cheyenne	37	13.80	22.63	5.04	4.5	1.6	2.8	0.36
Ft. Washakie	19	12.23	25.24	5.22	4.9	2.1	2.4	0.42
Idaho								
Lewiston	28	14.68	21.71	9.73	2.2	1.5	1.5	0.66
Boise	20	13.27	22.95	7.90	2.9	1.7	1.7	0.59
Oklahoma								
Ft. Smith	24	41.52	64.63	22.27	2.9	1.6	1.9	0.52
Ft. Sill	35	30.85	50.08	16.07	3.1	1.6	1.9	0.52
Washington								
Spokane	28	17.89	25.99	12.02	2.1	1.5	1.5	0.67
Ft. Canby	31	64.05	91.74	39.93	2.3	1.4	1.6	0.62
Oregon								
Astoria	37	37.06	61.56	18.96	3.2	1.7	2.0	0.51
Ft. Ross	35	54.22	88.17	23.61	3.7	1.6	2.3	0.43
Salem	39	39.60	54.93	24.56	2.2	1.4	1.6	0.62
Portland	50	42.45	67.24	30.76	2.2	1.6	1.4	0.72
Baker City	19	12.88	18.23	8.55	2.1	1.4	1.5	0.66
California								
Woodland	37	18.30	46.26	6.70	6.3	1.6	4.1	0.21
Tehama	39	19.51	46.26	18.54	5.4	2.4	2.3	0.46
Truckee	39	27.52	42.47	6.70	6.3	1.6	4.1	0.21
Summit	39	48.07	76.54	18.85	4.1	1.6	2.6	0.39
Sacramento	60	19.40	34.92	8.44	4.1	1.8	2.3	0.45
Redding	35	38.71	62.26	14.56	4.3	1.6	2.7	0.38
Marysville	38	19.76	36.63	11.17	3.3	1.9	1.8	0.56
Nevada City	45	55.64	102.85	30.03	3.4	1.8	1.9	0.54
Georgetown	37	58.62	99.62	28.13	3.6	1.7	2.1	0.48
Folsom	38	24.51	46.07	8.52	5.4	1.9	2.9	0.35

RAINFALL FACTORS FOR UNITED STATES—Continued

Stations	Years	Mean	Max	Min	Max. / Min.	Max. / Mean	Mean / Min.	Min. / Mean
Dairsville	38	17 26	31 74	6 97	4 5	1 8	2 5	0 40
Colfax	40	48 94	85 21	25 10	3 4	1 7	2 0	0 51
Cisco	40	52 02	95 03	21 83	4 3	1 8	2 4	0 42
Chico	39	23 39	37 27	12 31	3 0	1 6	1 9	0 53
Bowniarus	36	75 63	135 70	32 79	4 1	1 8	2 3	0 45
Boca	39	20 84	37 58	8 38	4 5	1 8	2 5	0 40
Auburn	39	35 13	60 63	18 07	3 4	1 7	1 9	0 52
Stöckton	43	14 63	26 43	6 38	4 1	1 8	2 3	0 44
Santa Barbara	42	17 32	43 23	7 22	6 0	2 5	2 4	0 35
San Mateo	35	20 84	34 28	8 00	4 3	1 6	2 6	0 38
San Jose	36	15 35	25 55	6 63	3 9	1 7	2 3	0 43
San Francisco	60	22 83	38 82	9 31	4 2	1 7	2 5	0 41
San Luis Obispo	40	21 95	49 99	6 93	7 2	2 3	3 2	0 31
Salinas	36	14 16	24 53	6 81	3 6	1 7	2 1	0 48
Oakland	35	24 54	38 20	11 09	2 4	1 5	2 4	0 41
Modesto	38	10 47	16 96	4 19	4 0	1 6	2 5	0 40
Los Banos	36	7 99	16 68	4 57	3 6	2 1	1 8	0 57
Livermore	38	16 27	27 65	7 63	3 6	1 7	2 2	0 47
Hollister	35	12 87	26 05	6 10	4 3	2 0	2 2	0 47
Gilroy	35	19 81	39 67	7 98	4 9	2 0	2 5	0 40
San Diego	60	9 54	27 59	3 02	9 1	2 9	3 1	0 32
San Bernardino	38	15 92	37 08	5 46	6 8	2 3	2 9	0 34
Nevada								
Beowaine	36	6 48	14 92	2 10	7 1	2 3	3 1	0 32
Winnemucca	35	8 65	18 38	4 89	3 7	2 1	1 8	0 57
Utah								
Moab	20	8 36	14 52	4 32	3 9	1 7	1 9	0 52
Corrine	38	12 51	22 35	5 41	4 1	1 8	2 3	0 43
Ogden	37	14 74	23 11	6 54	3 5	1 6	2 3	0 44
Salt Lake City	35	16 33	23 64	10 94	2 2	1 4	1 5	0 67
Colorado								
Las Animas	39	11 65	16 97	3 78	4 5	1 4	3 1	0 32
Denver	37	14 05	20 12	8 48	2 4	1 4	1 7	0 60
San Luis	30	10 95	18 85	5 00	3 8	1 7	2 2	0 46
Arizona								
Tucson	40	11 66	24 17	5 26	4 6	2 1	2 2	0 45
Yuma	38	3 13	11 41	0 60	1 9	3 6	5 3	0 19
Prescott	35	17 40	39 47	10 02	3 9	2 3	1 7	0 58
New Mexico								
San Marsal	40	9 06	21 81	2 22	9 8	2 4	4 0	0 25
Massila Park	47	8 62	17 09	3 49	4 9	2 0	2 5	0 40
Ft. Wingate	42	14 53	25 95	6 37	4 1	1 8	2 3	0 44
Sante Fe	50	14 72	25 80	7 75	3 8	1 7	1 9	0 53
Ft. Union	43	18 49	39 17	6 35	4 1	1 6	2 9	0 34

states. In the other Western states this tendency is not so marked, and the factor is less than in the above-mentioned regions. Along the Mexican border there are several districts where the factor is only 0.2 or 0.3.

A comparison of this map with a map of mean annual rainfall shows, generally speaking, that in the regions of moderate or heavy precipitation the minimum-mean factor is greater than in the regions of low precipitation, and when the average rainfall is below approximately 20 in. the minimum-mean factor, in general, decreases as the average rainfall decreases. It is also evident that the factor is greater on the North Atlantic coast, particularly in New England, than elsewhere. There are several stations in the Pacific Coast states, in eastern California particularly, where the normal precipitation is about the same as on the Atlantic Coast, but the minimum-mean factor is much less. It is of interest to note in this connection that the variations in monthly rainfall on the Pacific Coast are much more pronounced than on the Atlantic Coast.

Effect of Length of Record on Minimum-Mean

Our knowledge of the science of meteorology is not sufficiently advanced to state with accuracy the reasons why one year has less precipitation than another. The best that can be done is to say that an extremely low rainfall may occur once in a certain number of years—how many years no one can say exactly. Obviously, the longer the record the smaller will the minimum-mean factor be. The long records bear out this statement. For example, at Rochester, N. Y., Charlestown, S. C., Washington, D. C., and Boston, Mass., where the records are respectively 80, 115, 72 and 91 years in length, the factor is 0.5 for the first three and 0.6 for the last named city. To be sure there are a few other stations in eastern United States where the records are only about 40 years in length that have minimum-mean factors of from 0.4 to 0.5. However, for these stations it would undoubtedly be true that in a period of 100 years the factor would be no less, because the year of lowest rainfall in a 100-year period might occur in the first five years of the record or it might occur in the last five years.

Usefulness of the Minimum-Mean Factor

In hydraulic investigations it is often the case that only short records of precipitation are available, and it is desirable to know what the minimum rainfall for a long period of years would be. If the minimum-mean factor for the locality is known, at least an approximate estimate of the minimum rainfall can be made. For example, at Albany, N. Y., there is a long record of precipitation, 84 years in length. At Hoosick Falls, to the southeast of Albany, the record is only six years in length. The record at Hoosick Falls extends from 1904 to 1909, during which time the average precipitation was 38.16 in. The average rainfall for the 84-year record at Albany is 38.39 in., but from 1904 to 1909 it was only 30.13 in., considerably lower than the normal. It is undoubtedly true that Hoosick Falls also had a rainfall much below the average during this period. To estimate the least rainfall for this station the following calculations may be made:

$$For\ 50\ years\ \tfrac{2}{3}\left(\frac{38.39}{30.13}\times 38.16\right) = 32.42\ in.$$

$$For\ 100\ years\ \tfrac{1}{2}\left(\frac{38.39}{30.13}\times 38.16\right) = 24.31\ in.$$

The above relations may be taken as a formula as follows:

$$X = M\,\frac{(LS)}{L'}$$

in which

X = Required minimum rainfall;
M = Minimum-mean factor for the district;
L = Mean rainfall for entire period at adjacent station which has a long record;
L' = Mean rainfall at adjacent station during the period in which the records were taken at the station which has a short record;
S = The mean rainfall at the station which has a short record.

By averaging the results obtained in the above way from a number of adjacent stations with long records, a safe estimate of the minimum rainfall can be made. The results obtained from using the factors $\frac{1}{2}$ for 110 years and $\frac{2}{3}$ for 50 years are conservative for eastern United States. These factors, however, should not be used for the western part of the country, for they are shown to be much less west of the Mississippi River.

It is to be expected that the average rainfall for an entire river drainage basin will not vary to such an extent as the rainfall for an individual station. Therefore, the minimum rainfall will more nearly approach the mean, so that the minimum-mean factor will be greater for a large area than at a single station. However, it is not safe to assume, especially where the climatic conditions are much the same over the entire watershed, that the minimum-mean factor should be more than 10% greater for an entire river drainage basin than at an individual station. While this statement may seem too conservative, the writer has found it to be the case in working out the factor for a number of widely separated large areas, the data for which are not given on account of lack of space.

Coreless Hydraulic-Fill Dam Built of Lava

By J. W. Swaren*

A coreless earth dam 1550 ft. long has been built by the Lewiston-Sweetwater Irrigating Co., in western Idaho, where the only available soil was lava ash and weathered lava. In spite of the nature of the material the maximum seepage is small.

The dam at present is 442 ft. wide on the base, 54 ft. high and 1550 ft. long. It is designed for an ultimate height of 85 ft. and a crest length of 3600 ft. Its present storage capacity is 2466 acre-feet; when completed, its capacity will be 6682 acre-feet. The upstream face has a slope of 1 on 3, while a slope of 1 on 2 is given the downstream face. At the point selected for the dam, the profile of the ground surface is rather uneven; upstream a fill of 9 ft. was necessary to bring the prism to the grade of the axis. A puddle trench, 8 ft. deep and 10 ft. wide, is placed along the axis.

Construction began in 1906. The surface of the ground was stripped and scarified. During the spring months a dike along the upstream toe (*A*, Fig. 1) was raised about 31 ft. The earth was placed in 6-in. layers by wheeled scrapers, sprinkled, rolled and harrowed. During the summer months a similiar dike (*B*) was built along the

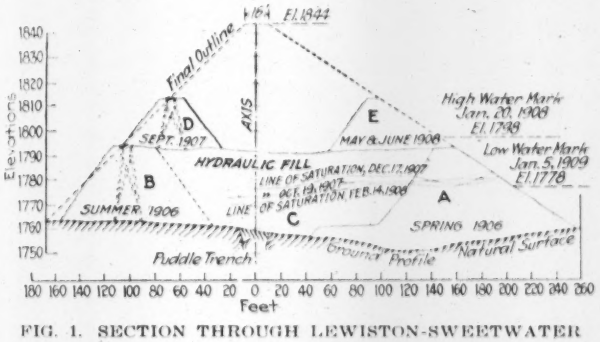


FIG. 1. SECTION THROUGH LEWISTON-SWEETWATER LAVA DAM

downstream toe. The material for this dike was dumped dry from a trestle. So far as possible, all material composing the dam prism has been taken from borrow pits inside the flooded area, in order to increase storage capacity. Puddle clay for sealing the toe was obtained from a small deposit near the north end.

While the dike along the downstream toe was being built, water for the irrigation season of 1906 was stored behind the upstream dike. During the fall and winter of 1906 and the spring of 1907 the prism (*C*) between these dikes was filled by a unique combination of water settling and dump-cars. Water from the main canal was conducted into the area between the upstream and the downstream dikes. Earth was dumped into this water from cars running on rails laid along the top of the upstream dike, the water in the pond between the dikes settling the earth firmly and at minimum cost.

Water was stored and used for the irrigation season of 1907; and no additional work was done on the dam until September, when a second dike (*D*) was made on the downstream toe, with its base on top of the fill already in place. The material was dumped from cars on a trestle and settled by water from a 1½-in. hose.

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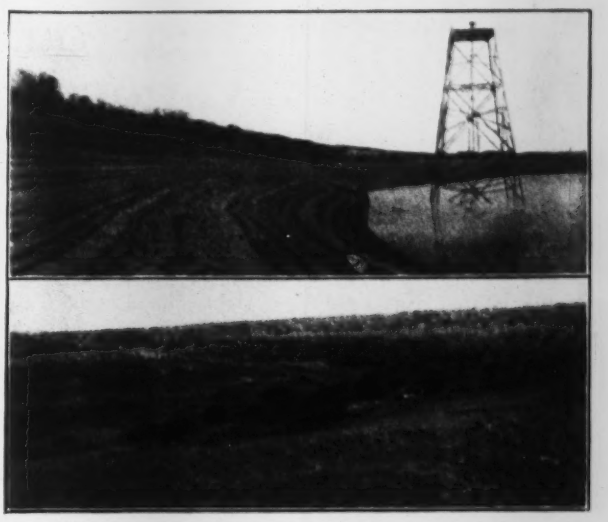


FIG. 2. UPSTREAM AND DOWNSTREAM SLOPES

Additional land coming under irrigation, a larger storage was required. Financial conditions were unsettled at this time, and completion of the dam was out of the question. As the cheapest method of securing the desired capacity, a dike (*E*) was built on the upstream toe, with its base on the fill already in place. This was built by dumping from cars on a track laid along the center of the fill; the earth was moved both ways by scrapers. This work was stopped at El. 1814, providing for a total storage of 2466 acre-feet, with water level at El. 1810.

A concrete tube laid in rock excavation under the dam serves as an outlet. When the concrete was poured, particular attention was given to filling and carefully tamping all crevices in the rock. This outlet, from the point where it pierces the upstream face, at El. 1760, to the axis of the dam, is 4 ft. in diameter. At this point it widens to 8 ft. in diameter and continues to the downstream face, where a wood-stave pipe line, the main conduit of the distribution system, joins.

At the point where the outlet conduit increases in diameter a concrete shaft rises to the top of the dam. Two 36-in. gate valves, with steel stems extending up the shaft, are placed at this point. A steel sluice gate, which is used in normal operation, is set where the outlet passes through the upstream face. A steel tower supports the operating mechanism for this gate.

The inner [illegible] of the dam displays the effect of wave action, each day's draw-down showing clearly in a little bench washed out of the fill. As the line of saturation is rather flat and shifts rapidly, the maximum storage is not made until the last snow run-off. The first irrigation period, closely following, draws down the water level well below the saturation line. During high water in the reservoir, careful watch is kept on a line of test pits along the downstream toe of the dike.

Drainage at the downstream toe is carefully developed, and no waterlogging of the prism occurs. At high-water period this drainage is 0.033 sec.-ft. After the close of the irrigating season, with the water at the level of the outlet pipe, drainage is only 1 cu.ft. in 29 min., indicating that in spite of unfavorable materials an excellent bond has been made between the dam and the original ground.

This dam was designed by L. G. Carpenter, of Fort Collins, Colo., who also supervised construction.

Impact Tests on Brick Paving Slabs Variously Construed

SYNOPSIS—Views of different paving engineers as to meaning of impact tests on sand-cushion and monolithic brick pavements.

The publication of the discussion of Prevost Hubbard, of the United States Office of Public Roads and Rural Engineering, on "Impact Test of the Efficacy of Sand Cushions in Brick Pavements," in *Engineering News*, Feb. 1, has brought out a number of interesting views as to what the tests actually showed. These opinions are published herewith, together with a further discussion by Mr. Hubbard.

Discussion by Paul E. Green,* of Chicago

In reading Mr. Hubbard's paper and the editorial referring to it, the writer is impressed with the fact that apparently neither your editorial nor Mr. Hubbard's report shows a clear understanding of the problem. Emphasis has been placed on non-essentials. The essentials are ignored.

If we go back to the fundamentals of road construction, there can be little question that, if a thoroughly dried, well-drained earth road is considered, it will stand practically any load that can be put upon it, with the possible exception of the enormous trucks that were referred to in your editorial; and even then it is probable that the thoroughly dried dirt road could be successfully used as a roadway. Fundamentally, the earth road is the foundation upon which all pavements are laid. Therefore, it is the earth that really withstands the load. Any pavement or surfacing that is placed thereon is for the purpose of securing a surface that is not affected by moisture, is smooth and dustless. The thickness of a wearing surface, provided it is a rigid wearing surface, has nothing to do with the problem.

The problem, therefore, as stated before, is to provide a rigid, or nearly so, wearing surface, which will shed water and will prevent moisture from getting into the subgrade. No construction yet attempted has achieved this result perfectly, but it is the belief that in the case of brick-surfaced roads the monolithic type approaches this ideal.

For many years brick highways and streets have been built with the sand cushion. There have been a good many failures of these roads and pavements, and engineers have been trying to find out the reason. Observation has generally shown that the brick had expanded; in nearly all cases of failure, before the failure occurred, the surface had heaved. A space was thus formed between the bottom of the brick and the sand cushion.

This heaving, accompanied by cracking, etc., and a consequent release of the pressure on the sand cushion, caused the sand to shift; water entered, part of the sand was pumped up through the cracks to the surface of the pavement and blown away, and other portions of the cushion were forced into heaps, from 2 to 4 in. in depth, with corresponding bare spaces of concrete at some points. The pavement became noisy. As soon as the bond of the surface was destroyed, the pavement could not go back to its original position and consequently within a comparatively short time would be utterly destroyed. It was because of this trouble that the monolithic type was developed.

If the surface of the pavement can be kept in its original position, a very large amount of the trouble will be permanently eliminated. This result is believed to have been obtained in the monolithic type. Experience extending over several years with various pavements, as for instance wood block, has shown that there is sufficient bond between the green mortar and the blocks (including the interstices) practically to eliminate separate movement between the base and the wearing surface.

It is possible to get a much smoother job with a mortar than it is with a plain sand bed. Experience is unanimous on this point. If, therefore, we take this point into account, with the demonstrated result as shown by Mr. Hubbard's experiments that the grout between the brick is much less liable to crack and spall in the monolithic type than in the sand-cushion type, do not the correlated facts go far toward proving the contention of those who are impressed with the desirable features of the monolithic construction?

It is the writer's belief that the greater smoothness of the mortar-joint pavement and the bond of the block to the base (even though this bond is limited) much more than compensate for the slight loss in cushioning effect of the sand, especially as the report shows very clearly that the strength of the monolithic type was fully equal to that of the sand-cushion type.

Discussion by W. W. Horner,* of St. Louis

The writer has been much interested in Prevost Hubbard's tests of impact on brick pavement, but is inclined to draw somewhat different conclusions from their analysis to those indicated in your editorial of Feb. 1. It seems to the writer that your editorial comments do not sufficiently emphasize the difference between the characteristics of the individual brick and those of the brick pavement as a whole.

In either type of pavement the resistance of the brick to impact is about double the resistance of the individual brick standing alone. The resistance of the sand-cushion pavement as a pavement, however, is less than that of the single brick, for the grout joints failed at a blow of 40 cm. Further blows apparently drove the center brick into the sand, and the sand bed undoubtedly absorbed much of the impact thereafter. In this way the life of the individual brick under the hammer was prolonged at the expense of the pavement as a pavement.

The resistance of the monolithic pavement as a whole was about double that of the individual brick, and this resistance is evidently accomplished by the rigid restraint that the surrounding brick and mortar bed exercised on the unit under impact. The important point is that the monolithic pavement remains efficient and uninjured practically to the last blow.

*Consulting Engineer.

*Engineer of Sewerage and Paving Design, City of St. Louis.

To summarize, the sand-cushion pavement does not secure the full value of the constituent material; the monolithic structure is twice as good as the brick it is made of. Experience has shown that the pavement in which the grout joints are broken is not only subject to very rapid further deterioration, but is almost immediately an unsatisfactory pavement. Very generally in a brick pavement with broken grout and invariably under heavy traffic, the sand cushion will be displaced, resulting in the formation of transverse ridges or waves and occasionally even an appreciable rut. In fact, the pavement with broken grout joints is, in this respect, inferior to a pavement that is merely sand filled. It will of course continue to carry traffic, but its rating by the common factors used to compare it with the ideal pavement will be enormously reduced.

I believe Mr. Hubbard's test should be analyzed on this basis; and if so considered, then the monolithic brick pavement will carry twice as heavy traffic as the sand-cushion pavement.

We know already that modern traffic produces sufficient impact to crack the grout joints of the sand-cushion type. We do not know that it produces an impact twice as great as necessary to do this. If it does, Mr. Hubbard's test indicates that the monolithic also will fail. If it does not, the monolithic type will never fail, but will wear out and will remain comparatively smooth and solid to the end. Even in the absence of further tests we can be certain that the monolithic pavement will provide for a heavier traffic than did the old type.

In the tests the monolithic type finally failed as a whole; that is, it cracked through the base. This is in accord with theory. If a test could be arranged on somewhat larger specimens and if the specimens of both types should be tested on a firm soil instead of upon the anvil base, is it not reasonable to expect that the monolithic type would show even greater superiority than has been indicated? Is it not possible that under these conditions, which are actually service conditions, the brick will be worn to pieces on the surface before the base cracks?

Discussion by Will P. Blair,* of Cleveland

The recent discussion that has taken place involving the relative influence of impact upon a brick pavement constructed in monolithic form and one constructed on a sand cushion does not seem to the writer to meet the real or practical question. The inquiry should be as to which practice is better. It will not do to draw any definite conclusion from a half-dozen laboratory tests.

The one reason for engineers clinging so long to the use of the sand cushion was the belief that the resiliency afforded was necessary for the protection of the brick against shock and impact, but its necessity, doubted by some for several years, is not now considered necessary at all by those who have studied and observed the behavior of both types.

The only reason for the use of the sand cushion under stone or brick was to prevent their breaking and shattering, but is now well established, not only by laboratory experiments, but by hundreds of pavements, that the sand cushion is not necessary. In none can shock effects be observed. We therefore have hundreds and thousands of practical experiments that afford proof that the sand cushion is not necessary for the protection of brick in its actual use in pavements.

But granting a resilient relief is one of benefit, the same relief is given the pavement as a whole by the earth under the monolithic slab as by the sand cushion under the brick. It does not matter from a practical standpoint what is the measure of relief in the use of a sand cushion supporting a 4-in. slab or with the earth supporting an 8- or 10-in. slab. It is the greatest advantage in the practical use and economy of materials that is wanted.

That brick and stone pavements constructed upon 1½- and 2-in. sand beds have remained in good condition while subject to excessive wear for many years is sufficient proof that such pavements are economical and well worth all they cost. However, it is true that it has been very difficult to induce those building pavements to properly compress and compact the sand cushion; and where this neglect has occurred, bad results have followed. This practice therefore involves a hazard which, if possible to avoid, is but an act of wisdom. At the very worst the monolithic pavements afford results equal to the best of any other method, and the hazard in construction is eliminated.

Concluding Note by Prevost Hubbard

The writer wishes to note that the conclusions given in his report were based only upon the experimental data submitted, as with one exception he did not feel warranted at this stage of the investigation in undertaking to point out just how the information gained could be most advantageously applied in practice.

Mr. Horner's discussion of the inherent defects of the sand-cushion type of pavement impresses the writer as having been well thought out and ably presented. He can readily see how upon the basis of Mr. Horner's argument some such comparison of the monolithic and sand cushion types might be drawn. He is inclined to regret, however, that Mr. Horner apparently overlooked the significance of what to the writer appears to be the most illuminating result of the tests. This is the fact that failure of the foundation occurred along with the brick in the monolithic type, while in the sand-cushion type a foundation of the same thickness (6 in.) remained intact under equally severe tests.

The only conclusion in the original report specifically applied to engineering practice was based upon this foundation weakness of the monolithic type, which seems to throw into question the practice recommended by some engineers of employing a foundation of less thickness than with the sand-cushion type.

One of the principal advantages frequently claimed for the monolithic type is the reduction in construction cost due to the possibility of decreasing the foundation thickness. In view of the test results, however, it would certainly appear that engineers should go very slowly in economizing on the foundation where the monolithic type is employed.

More than this, there are other features of monolithic construction which are of great merit. It may be well to mention two very important ones, namely: (1) The minimizing of noise, which places brick pavements so constructed in the very highest class in this respect. (2) A pavement is secured which affords a surface unsur-

*Secretary, National Paving Brick Manufacturers' Association.

passed for ease of cleaning. If, therefore, the construction of a brick pavement in monolithic form gives to the public the most and best for its money, is not that after all the end of the argument?

Cumulative experience has caused the use of a thin foundation to be largely abandoned, where the sand cushion is used, and until a great deal of positive experimental data is obtained, it would seem unwise to adopt a thin foundation for the monolithic type.

The writer plans to continue tests on sections of brick pavements and hopes that engineers will feel free to offer suggestions as to how the methods may be improved so as to make the results of practical value.

Concrete Mat on Confined Sand Supports Boiler Plant

To found a large boiler house on wet-flowing sand in the downtown district of New York City, a thick reinforced-concrete mat was designed with the sand underneath confined by a ring of interlocking steel sheetpiling. At this location, hardpan sloped rapidly eastward; and core borings showed that, although good bearing could be obtained on the west side of the lot, piers would have to be put down 70 ft. on the east side, if hardpan were to be reached. This would have called for compressed air and would have been very expensive. The alternative was a spread footing, and the one designed by Daniel E. Moran, consulting engineer for the New York Steam Co., and constructed by The Foundation Co. is quite remarkable. The plant divides naturally, as regards loads, into boiler house and coal bunkers, and the two elements were treated as separate buildings. They adjoin, but do not connect, being separated by a paper slip-joint. The site is 107 x 116 ft., the bunker house being the full width of the building by about 26 ft. wide. The first operation was to put down a steel sheetpile cofferdam to a depth of 24 ft. below curb all around the lot. A steam shovel inside the sheetpiling excavated to grade. After the pit had been cleaned up by hand, a 6-in. carpet of cinder concrete was laid to serve as a working floor and to keep the bottom clean and undisturbed. On this surface the forms were erected and the reinforcing steel was laid, all the rods being placed before concreting was started. The design of the mat is given

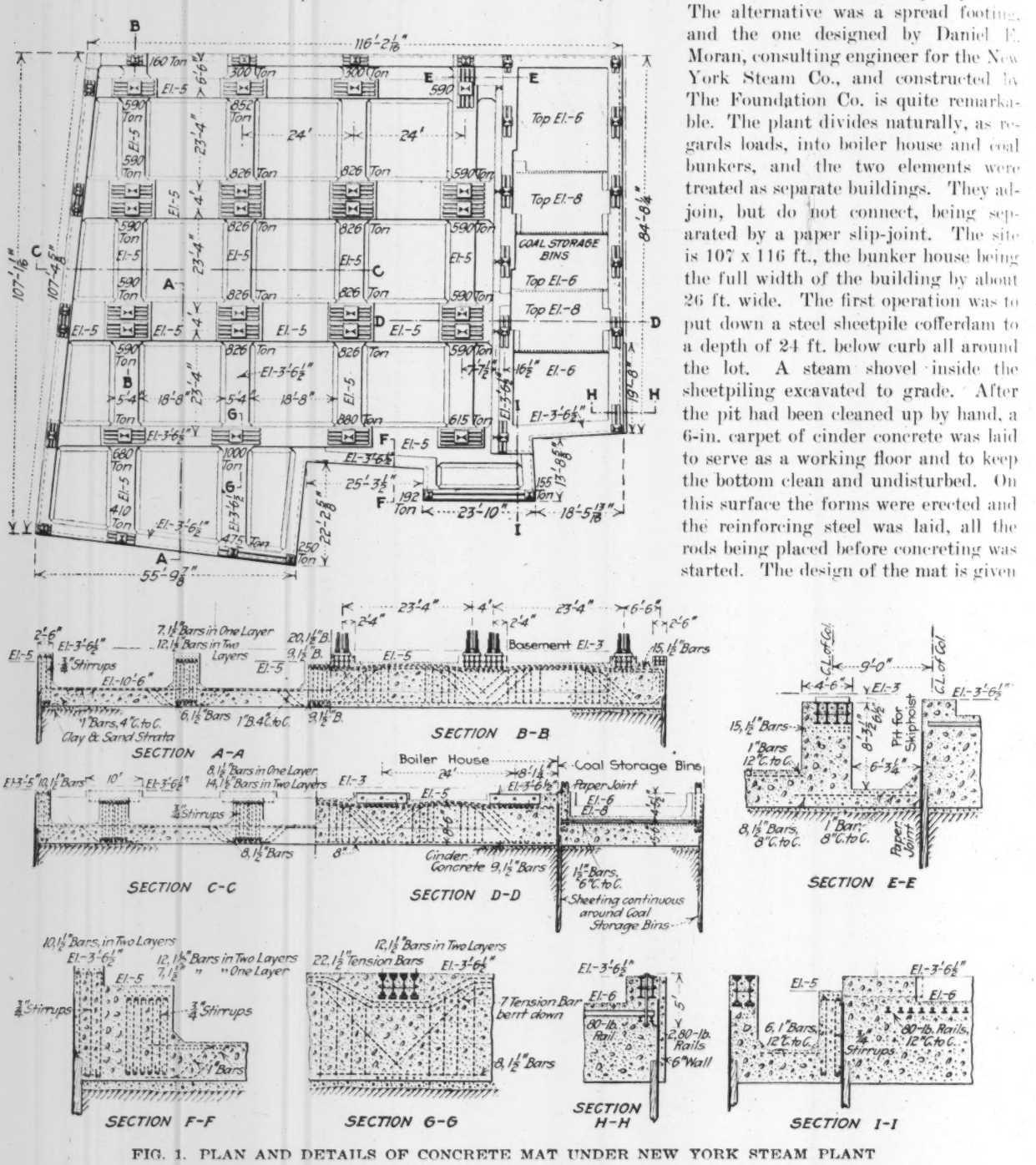


FIG. 1. PLAN AND DETAILS OF CONCRETE MAT UNDER NEW YORK STEAM PLANT

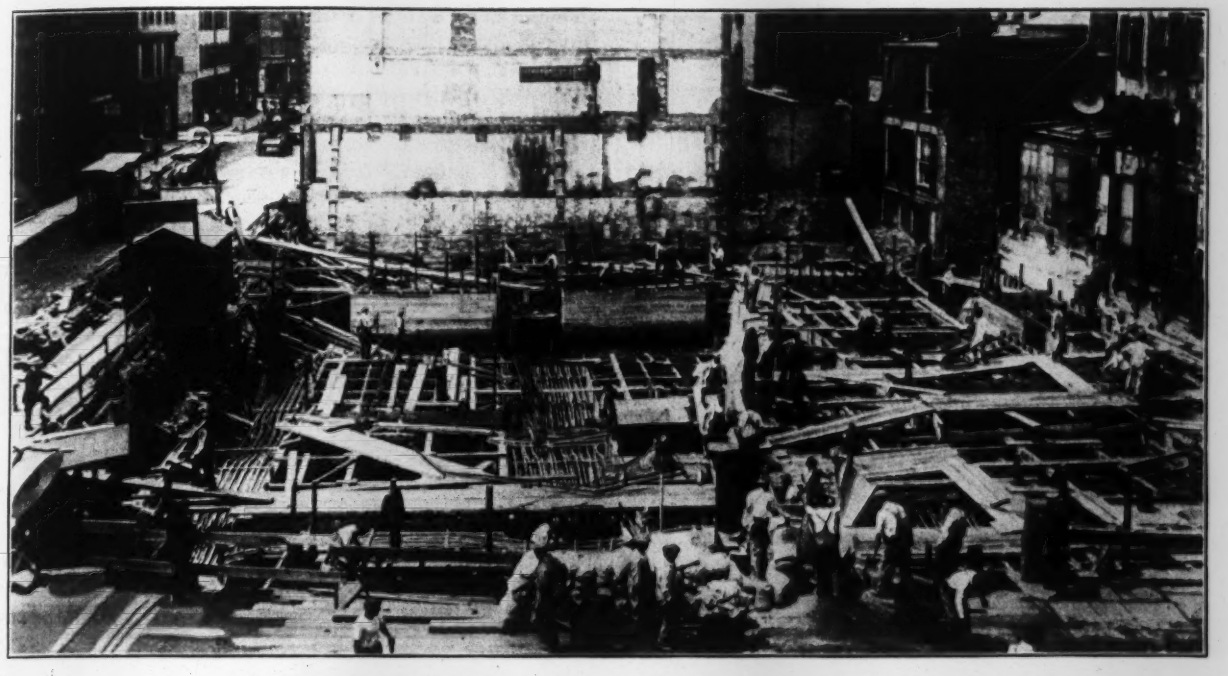


FIG. 2. SHOWING HEAVY REINFORCEMENT IN PLACE IN STEAM-PLANT FOUNDATION

in Fig. 1. The slab is 36 in. thick, with its bottom 13½ ft. below curb. It is reinforced with 1-in. bars, 4 in. apart and placed both ways. Every other bar is bent for shear. All the reinforcement bars are square twisted. On top of the slab, but monolithic with it, is the concrete-girder system. The largest girder, 8 ft. 8 in. wide by 8 ft. 6 in. deep from bottom of slab, is reinforced with twenty-nine 1½-in. bars and is provided with shear rods.

The girder forms were built on stilts set in wood sockets or post holes, as illustrated in Fig. 3. The concreting was carried on as nearly continuously as possible. There were no horizontal joints, and where a

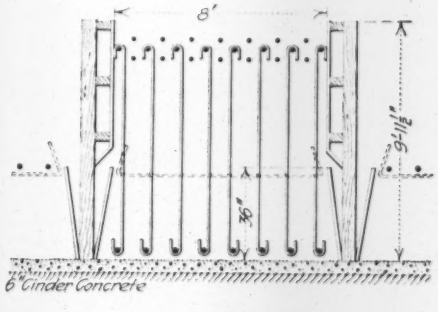


FIG. 3. SCHEME OF SUPPORTING SLAB FORMS AND REINFORCEMENT

vertical joint was necessary, it was formed at column points. After concreting, the wood sockets were removed and the reinforcing rods were bent down and the post holes concreted.

Before the forms were erected, the slab steel was laid on the ground; and as soon as the forms were in place, this steel was lifted to its final position and wired to the girder forms. Special precautions were taken that the steel remain absolutely in place. Fig. 2 is an excellent view of the reinforcement and forms in place and concreting in progress.

The concrete mixer was installed off the lot, and the concrete was transported in buggies. This hand placing of concrete was very satisfactory. In spite of the close spacing of the reinforcing, there was no special difficulty in placing the concrete, which was soft and had aggregate of less than 1 in.

The bunker house, having capacity for 5000 tons of coal and 1000 tons of ashes, is carried on a 7½-ft. slab reinforced with 80-lb. rails, spaced 12 in. c. to c. and put in with spacers to hold them in position. The joint between the two buildings was formed as follows: Two coats of hot coal-tar pitch were applied to the surface of the concrete wall first built, then three plies of heavy-weight tar paper were put on and covered with a coat of hot pitch.

The load of the boiler room averages 2.6 tons per sq.ft. of the entire foundation. For the coal-plant mat the load is 5.4 tons. The main center panels have twin columns, each bearing 826 tons. The columns of the main bays are spaced 24 ft. apart in one direction and 27 ft. 4 in. in the other. The wall loading per column varies from 225 to 475 tons and averages 300 tons. The loading around the bunker walls is 48 tons per lin.ft.

Prize Designs for Workmen's Dwellings Announced—Prizes of $300 to $100 offered by the National Americanization Committee about a year ago, in connection with the movement for better housing of immigrants newly arrived in America, have now been awarded. The object of the competition was to produce good and economical plans for low-cost dwellings to be used as standard types in directing the attention of manufacturers, property owners and municipalities to the importance of industrial housing. The competition was divided into four classes, with two prizes of $300 and $200 in each case. First prize for a four-room single-family house was awarded William Lyon Summerville and Atwell J. King. Murphy & Dana were awarded first prize for a five-room single-family double house, while Messrs. Summerville and King received first prize for a single-family house to have four lodgers. Under the fourth classification, calling for a boarding house and carrying no prizes, Messrs. Summerville and King, John A. Thompson and Ernest F. Lewis, Henry E. Hill and Edwin F. Dodge received special mention.

Delivering Mixed Aggregate Along the 85-Mile Winnipeg Aqueduct

By Douglas L. McLean*

The concrete aqueduct section of the new Winnipeg water-supply is 85 miles long, so that the problem of concrete manufacture was somewhat complicated. One important factor in the successful construction was the use of a central plant where concrete aggregate was mixed in proper proportions and from which the mixed aggregate was transported to the 14 mixing plants located at set intervals along the line.

As the route of the pipe line passed through unsettled country, it was necessary to build a standard-gage railway for transportation of materials entering into the construction of the aqueduct. This railway runs parallel to the center line of the aqueduct and at a distance therefrom of 110 ft. In order to secure a regular supply of material to the various contractors' camps and because

FIG. 1. LOADING MIXED AGGREGATE AT MIXING PLANT

the railway that was the only practical means of transport for materials entering into the aqueduct construction was to be operated by the district forces, it was early decided that the supplying of sand and gravel for concrete could be most economically handled in conjunction with the other work being done by the district. This conclusion led to studies of the cheapest method of hauling and handling such materials with standard-gage railway equipment. It was shown that by the use of mixed aggregate a saving could be made of one-eighth the number of cars required for the delivery of sand and gravel separately. Further investigations showed other advantages, which resulted in the decision to supply graded aggregate from a central mixing plant.

Source of Aggregate Supply

A gravel deposit at Mile 31 on the railway was chosen as the source of supply for this aggregate. Test pits showed it to contain a large supply of gravel with a well-graded sand, considerable quantities of oversize, and at one end of the pit a deposit of very fine sand. This pit as opened up has a 25-ft. face with about 2 ft. of stripping on top. A 15-ton Browning locomotive crane equipped with a 1½-cu.yd. bucket and a 42-ft. boom are used for stripping, loading fine sand, spotting cars, moving track and as a spare for excavating. A No. Bucyrus dragline with a 2-cu.yd. bucket and a 60 boom is used for excavating the gravel. This machi operating from the top of the pit has a great advant over a steam shovel in that it is able to leave clay

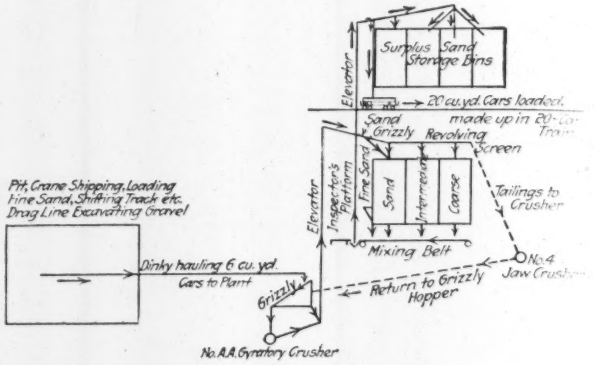


FIG. 2. DIAGRAM SHOWING OPERATIONS AT MIXING PLANT

material high in sand right in the pit and also because the cars serving it do not require to be operated up and down a steep grade into the pit bottom, as would be required for steam-shovel operations.

The operations for excavation at the pit to final loading into the dump-cars for transportation on the district railway are shown diagrammatically by Fig. 2. The materials excavated by the dragline are loaded into 6-yd. Western dump-cars and hauled by a 19-ton steam dinkey locomotive to the screening plant. Here the materials are dumped upon an inclined grizzly with bars spaced to give 3-in. clear opening. The oversize is fed by hand from this grizzly into a No. 4-A gyratory crusher and thence, after crushing, to the elevator, which carries the gravel from the grizzly hopper up to the screens. A sand grizzly 4 ft. long with ⅜-in. clear openings is located in the chute leading to the revolving screen. This screen, which revolves at 18 r.p.m., is 48 in. in diameter and is divided into three sections: The first is 10 ft. long with ⅜ x 1-in. long slots; the second is 4 ft. long with 1½-in. diameter round holes; and the third is 4 ft. long with 2¼-in. diameter round holes. Oversize from this screen is tailed to a No. 4 champion jaw crusher and thence elevated back to the hopper under the main grizzly.

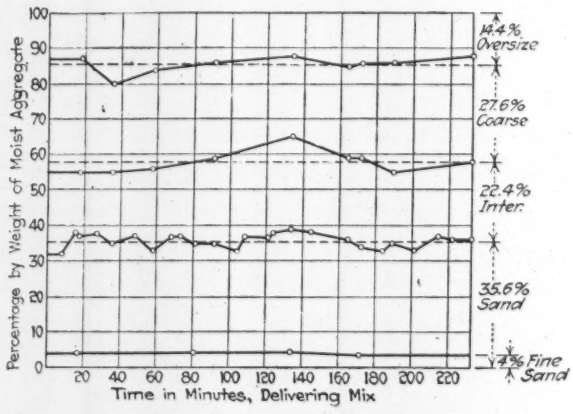


FIG. 3. VARIATION IN AGGREGATE AT SCREENING PLANT DURING TYPICAL RUN

*Assistant to Chief Engineer, Greater Winnipeg Aqueduct District, Winnipeg, Man.

The materials from the screens pass into three bins—respectively sand, intermediate and coarse stones. From these bins the material is drawn through hoppers and chutes with hand regulating gates to a mixing belt. The mixing of the aggregate is done by three laborers under the direction of a skilled inspector. First, the material from the coarse bins comes upon the mixing belt, which travels at the rate of 300 ft. per min.; then the material from the intermediate bin comes on top of the coarse material; and last, the sand comes on top of the other two materials.

In certain sections of the pit the sand is deficient in fine grains, and here the fine sand is added by means of the crane. For the day shift, loaded trains of 6-yd. dump-cars are run back under the crane, which adds fine sand to each carload. For the night shift, the crane loads up a number of carloads of fine sand, which are dumped where the dragline is excavating. The dragline runner then digs this fine sand in with the material he is loading. Thus the inspector has to see that the sand has sufficient fine material. If it is too coarse, he can

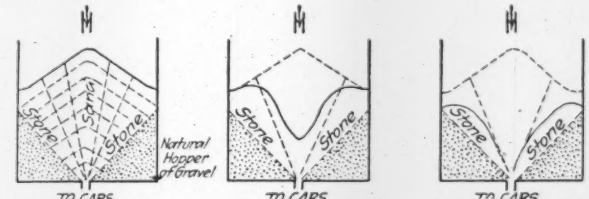

Stone
Sand
Natural Hopper of Gravel
TO CARS
(1) Storage Bin with 3 Cars of Aggregate. Note Segregation of Sand and Stone due to the Coming of Pile
TO CARS
(2) Aggregate being drawn from Bin. Note that First Car loaded is very sandy, next Car loaded is almost right as to Total Amounts of Sand and Gravel but is not mixed uniformly
TO CARS
(3) Shows third Car being loaded from Bin. Note that this Car contains nearly all coarse Material

FIG. 4. DIAGRAM SHOWING HOW STORAGE IN BIN AND LOADING SEPARATES AGGREGATE

run it off to the surplus-sand storage bins. In order to oversee the mixing, the inspector's platform is located at the delivery end of the mixing belt, so that he can direct the laborers as to the quantities required for each chute.

Variation in the Material

For sampling, a V-shaped trough is used, which catches the material coming off the mixing belt. The accumulated material is then piled on a sheet of iron that also serves as the floor of the platform. It is mixed by shovel, and then a 20-lb. sample is taken for mechanical analysis. One sample is taken for each car shipped, and control samples are taken whenever the inspector notices any change in the mixture. The percentage of fine sand and moisture is checked from 1-lb. samples. The daily-report form is made out by the inspector, and a copy of it is sent into the head office (Fig. 6). The materials entering into aggregate are classified as follows:

Fine sand	Material passing No. 100 sieve; square opening
Sand	Material passing ¼-in. square opening
Intermediate	Material passing ½-in. square opening and held on ¼-in. square opening
Coarse	Material passing 1½-in. square opening and held on ½-in. square opening
Oversize	Material passing 2¼-in. diameter round hole and held on 1½-in. square opening

The mixture for aggregate (determined by extensive laboratory research) is kept within the following limits:

Fine sand	10 to 20% of the dry weight of sand
Sand	32 to 40% of the dry weight of aggregate with 35% as objective
Sand and intermediate	Not more than 70% by dry weight of aggregate
Oversize	Not more than 25% by dry weight of aggregate

FIG. 5. AGGREGATE TRAIN EN ROUTE ON WINNIPEG AQUEDUCT

Fig. 3 shows the range of the variations in a typical day's run when the aggregate was mixed at the rate of 90 cu.yd. per hour. The mixed aggregate is elevated and discharged direct into dump-cars of 20 cu.yd. capacity, which are moved along by a car puller and switched by dinkey to the storage track, ready to be made up into trains of 18 to 20 cars. A number of methods were tried to provide storage of the mixed aggregate in bins, but this could not be accomplished at reasonable cost. The coming action of gravel in the bins unmixes the aggregate as it is deposited in storage, and it is further segregated when the material is drawn into cars from the bottom of the storage bins. This is shown diagrammatically in Fig. 4.

Transporting the Mixed Aggregate

The maximum output of the season of 1915, in one day, two 10-hour shifts, was 1357 cu.yd. of mixed aggregate and 160 yd. of surplus sand. In 1915 this plant supplied 58,000 cu.yd. of mixed aggregate and 30,000 cu.yd. of other materials, and in 1916 some 130,000 cu.yd. of aggregate and 12,000 cu.yd. of other material.

For transporting the aggregate the district standard-gage railway is used. As required from day to day, trains of 10 to 20 cars (20 cu.yd., air dump) are made up and hauled out to distribute the aggregate to the site of its use (Fig. 5). In transport there is no segregation of the mixed aggregate, though a shrinkage of from 3 to 10% occurs. At each site of work, plank platforms are provided by the contractors for the reception of the aggregate (see Fig. 8). In dumping upon the platform, there is a tendency toward slight segregation, as the coarse material rolls away from the railway track. Such slight segregation is overcome by the contractors' men in loading the material for the mixer; they dig swaths in the pile of aggregate at right angles to the railway track.

The aggregate is sold to the contractor at 75c. per cu.yd. for sand and 75c. per cu.yd. of gravel delivered from cars at the site of work. The aggregate is measured at the plant. The contractor is allowed 10% shrinkage in transit, and he pays on the basis of the yardage of separated materials. Two years' experience on this work

GREATER WINNIPEG WATER DISTRICT

DAILY REPORT OF SAND AND GRAVEL INSPECTION

AT PIT NO. .....

W. G. CHACE,
Chief Engineer
Dear Sir,

I beg to report for ..... 191 ... as follows:

SAMPLE No.	TIME Hour	TIME Min.	MECHANICAL ANALYSIS AT MIXING BELT				REMARKS

AVERAGE OF SAMPLES NO. ... TO NO. ...

SAND Size of Screen	SAND % by Wt. Retained	SAND Cumulative Passing	GRAVEL Size of Screen	GRAVEL % by Wt. Retained	GRAVEL Cumulative Passing
¾			1½		
No. 10			1¼		
No. 20			1		
No. 40			¾		
No. 75			½		
No. 100			⅜		
Thru No. 100			¼		

SUMMARY OF PIT OPERATIONS

OUTPUT IN CU. YDS.

Sand	Fine Sand	Pit Run	Gravel	Aggregate	Other Materials

	Hrs.	Min.
Plant Running		
Belt Running Sand		
Belt Running Gravel		
Belt Running Aggregate		

Certified Correct ..... Noted .....

Date .....

Inspector

FIG. 6. FACSIMILE OF DAILY AGGREGATE REPORT

with graded aggregate has shown it to give the following results:

1. A dense impermeable concrete, uniform at all working points.

2. A saving in cement quantities. The mixture at present used is three bags (87½ lb. gross each) of portland cement to 18 cu.ft. of loose moist aggregate. This gives some 1.15 bbl. (376 lb.) of cement to each cubic yard of set concrete. This may be compared with 1.57 bbl. of cement per cubic yard for 1:2:4 mixtures commonly specified and used for supposedly water-tight work. The saving in using the Water District mixture over an ordinary 1:2:4 mixture, with cement at $2.75 per bbl. of 350 lb. delivered on the site of the work, will amount to $350,000 on 400,000 cu.yd. of concrete, the approximate quantity required for this water-supply project.

3. At the pit only is it necessary to have inspectors trained in the proper proportioning of the materials.

4. Proper proportioning of all ingredients of the aggregate necessary for the desired water-tight and economic concrete is possible only at the pit. The cost of mixing is 1c. per cu.yd. of aggregate.

5. A saving of one-eighth the number of cars that would be required for the delivery of sand and gravel separately. This item amounts to about $10,000.

6. The mixed aggregate is easier and cheaper for the contractor to handle than are separated materials.

James H. Fuertes, New York, is Consulting Engineer of the Greater Winnipeg Water Commission; W. G. Chace is Chief Engineer; M. V. Sauer is Engineer of Design and Deputy to the Chief Engineer. The writer is assistant to the Chief Engineer with special charge of work relating to test and inspection of cement and aggregate.

FIG. 7. 20-CU.YD. CAR DUMPING AGGREGATE ON CONTRACTOR'S PLATFORM

How Price of Railway Supplies Has Risen

New data on the increased price of railway supplies were given by George S. Patterson, general solicitor of the Pennsylvania Railroad Co., when he appeared on Mar. 7, before the Pennsylvania Public Service Commission in connection with the proposed compromise of the anthracite freight-rate case, which has been under litigation in the Dauphin County court. (The railroad company is willing to accept compromised rates on anthracite coal to end the litigation and out of deference to the state commission; but it is unwilling to accept the rates fixed by the state commission, in view of the old rates being accepted by the Interstate Commerce Commission and because of the great rise in cost of supplies.) The Pennsylvania figures are summarized below:

PRICE INCREASES OF RAILWAY EQUIPMENT AND SUPPLIES, PENNSYLVANIA R.R.

	1914	1917	% Increase
L. 1 8 locomotives	$28,500	$39,500	38 6
Standard steel passenger car	$15,000	$20,000	33 0
Standard steel gondola car	$1,184 (1915)	$2,569	117 0
Couplers, per pair	$16 60	$30 30	82 6
Axles, per lb	1 5c.	4 1c.	173 4
Bridge steel, per lb	1 83c.	4 71c.	157 5
Steel tires, per lb	3 25	6 50	100 0
Rolled wheels, each	$15 50	$20 50	32 2
Steel billets, per ton	$25 to $31	$77 to $79	178 5
Plates and shapes, per lb	1 05 to 1 10c.	4 to 4 5c.	295 0
Bar iron, per lb	1 20 to 1 30c.	3c.	140 0
Steel castings, per lb	2 60 to 6 10c.	5 50 to 11c.	89 5

The Pennsylvania Lines East in 1916 purchased about $70,000,000 worth of materials and supplies, exclusive of fuel and equipment. On the basis of 1917 prices these purchases would cost $78,000,000.

Frequent changes in labor (30,000 new men being employed during the year) have reduced the efficiency of the labor above the rates of pay, which have been advanced to meet industrial competition.

In 1916 the Pennsylvania Lines East consumed nearly 12,000,000 tons of bituminous coal, which was secured at $1.25 per ton. This coal is now selling for immediate delivery at the mines at $5 to $6.50 per ton, and contracts for the year commencing Apr. 1 are being made at $3.50 per ton. It is expected that the cost of fuel to the railroad will increase by some $8,000,000.

In ten years the taxes have risen from 8c. to 14c. per $1 of net operating revenue. The increase in 1916 was due to the increase in the Federal income tax.

Spring Frictions Will Hold Quebec Span Against Drag of Braked Trains

By A. J. Meyers*

SYNOPSIS—The long suspended span of the Quebec Bridge, 640 ft. between pins, will be subject to a sudden movement, over the 17-in. leeway provided, when brakes are applied to a high-speed train passing over it. In order to restrain this influence a traction brake is provided at end of cantilever arms.

On account of the unusually large span of the Quebec Bridge, 1800 ft. between main piers, an exceptionally large amount of motion due to changes of temperature and stress-deformation of the truss members had to be provided for.

The 640-ft. suspended span is hung from the ends of the cantilever arms by a double chain of eye-bars at each of the four corners of the span. The total amount of expansion provided for at each of these points is about 17 in. In order to prevent any sudden movement of this span, due to the application of the brakes to a train moving over it at a high rate of speed, it was thought advisable to apply a restraining influence to the maximum amount of traction force that could be applied at any one time—amounting to about 500,000 lb. at each of the four corners.

To accomplish this result it was necessary to design an instrument which, while allowing the 17 in. of motion, would be able to apply a resisting force to the traction at any point of this motion.

For this purpose what may be called a laminated friction brake will be used. This brake, as shown in Fig. 2, is made up of a series of plates that slide between each other and are kept in contact by a set of car springs under a constant compression. Every alternate plate is fixed by a pin at one end to the horizontal piece of chord at the end of the cantilever arm and has a slotted hole at the other end, to allow the necessary motion on the pin, which fixes the remaining sliding plates to the suspended span. These remaining plates are slotted in a similar manner, so as to allow the same amount of motion on the pin connecting the first-mentioned plates to the cantilever arm.

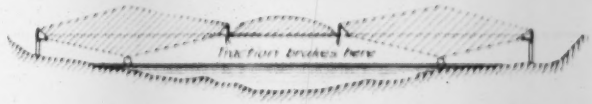


FIG. 1. DIAGRAM OF QUEBEC BRIDGE TO SHOW POSITION OF BRAKES

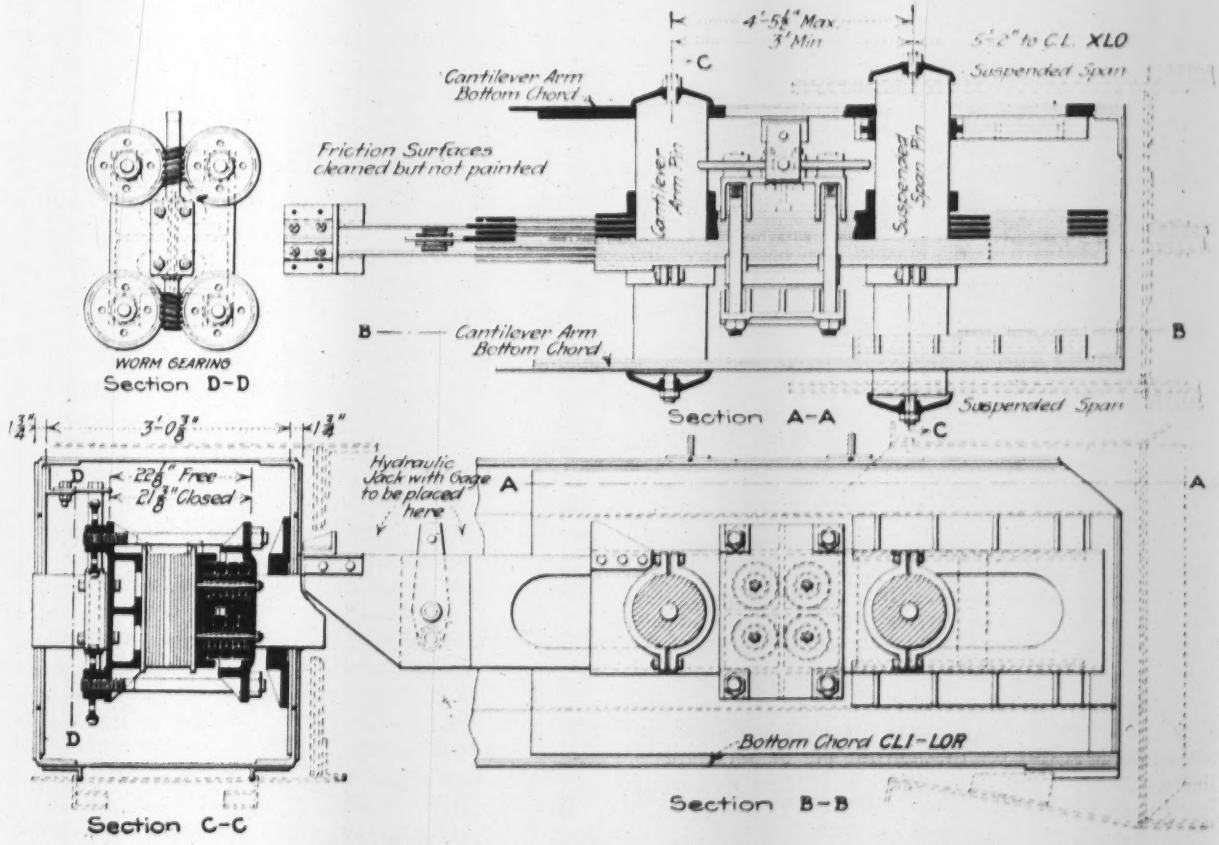
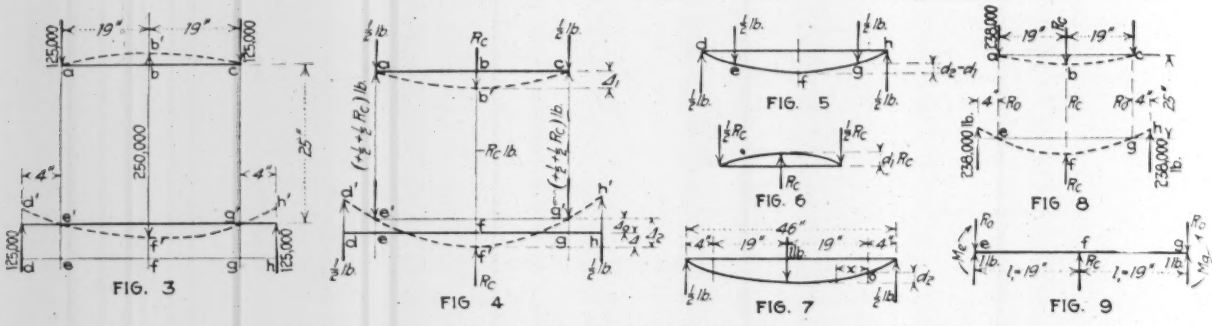


FIG. 2. TRACTION BRAKE FOR SUSPENDED SPAN OF QUEBEC BRIDGE

*Chief Draftsman, Board of Engineers, Quebec Bridge, Montreal, P. Q.

Each brake is designed for a working resistance, to begin with, of 250,000 lb. This force is developed by the friction between the 14 contact surfaces. Between each of the surfaces there must be developed a frictional resistance of $250{,}000 \times {}^{1}/_{14} = 18{,}000$ lb. If we figure on a minimum coefficient of friction of 15% this will require that the plates be pressed together by a force of $18{,}000 \times {}^{100}/_{15} = 120{,}000$ lb. To obtain a force of this amount, four double helical springs, each double spring having a capacity when closed of 38,000 lb., are used for each brake. The outer coil is made up of $1\frac{9}{16}$ in. square and the inner coil of ¾ in. square steel. The springs have a height, closed, of 6¼ in., and open of 7 in.



FIGS. 3 TO 9. DIAGRAMS FOR DETERMINATION OF BRAKE-PIN STRESS

The middle sliding plate is detailed so that the amount of frictional resistance can be ascertained by applying to it a small hydraulic jack with a gage. The springs will be compressed by means of the worm gearing shown in the illustrations, until this middle plate develops a resistance to motion, as measured by the gage, of 36,000 lb., since the plate has two contact surfaces.

This brake force of 250,000 lb. is constantly acting and the brake in constant motion, due to changing temperature and deformation of the trusses under moving loads. The contact surfaces will therefore wear to some extent, and the springs will also take a certain amount of permanent set under the constant compression acting. The effect will be to reduce partly the resistance of the brake, but the amount of this resistance can be tested from time to time by means of the jack and gage mentioned, and the springs tightened up if necessary by means of the worm gearing.

The total longitudinal forces passing through this joint amount to 726,000 lb. at each corner of one end of the suspended span. When it happens that the wind and traction forces act together, the span will move under their influence, with each brake resisting to the extent of 250,000 lb. until the pin, connecting the suspended span to the brake, comes to a bearing at the end of the slotted hole in the chord of the cantilever arm, when the greater part of this 726,000 lb. will be transmitted directly through this pin to the chords.

To determine the maximum bending in this pin was an interesting problem, since it is not known what part of the force of 726,000 lb. passes through the brake and what part goes directly through the pin to the chords of the cantilever arm. The solution of this problem is given herewith:

In Fig. 3 the lines dd' and hh' are center lines of ribs from the suspended span; the lines ae and cg are center lines of ribs of the cantilever-arm chord; the line bf the center line of the brake; the lines abc and dfh a center lines of the pins before any load comes on t brake; the curved lines $ab'c$ and $d'f'h'$ are center lin of the pins after the force of 250,000 lb. has been a plied and the brake has slipped under the action of th force until the pin just touches at the points e' and g'. As the load comes on the pin dfh, the pin bends, but no sliding of the brake results until this load has reached the resisting capacity of the brake, or 250,000 lb. The brake then slides, and the sliding continues until the pin dfh comes to a bearing at the points e' and g', when the total force of 726,000 lb. is immediately resisted. No further sliding of the brake takes place, as the pin now becomes continuous over three supports, a negative reaction from the load of $726{,}000 - 250{,}000 = 476{,}000$ lb. resulting at the point f', which reduces the initial brake stress of 250,000 lb. The problem is to find out the amount of this reduction in stress.

In the following analysis let

δ_1 = Deflection of the pin abc under 1-lb. load at b on a span ac equal to 38 in.;

δ_c = Elastic deformation of the brake bf under stress of 1 lb.;

δ_0 = Elastic deformation of ribs ae or cg of the cantilever arm under stress of 1 lb.;

δ_2 = Deflection on a length eg, equal to 38 in. of the pin dfh under a load of 1 lb. at f, the pin having a span dh equal to 46 in.

Further, as shown in Fig. 4, let a load of ½ lb. be applied at each of the points d and h. The pins deform from the positions abc and dfh, before applying this load, to the positions $ab'c$ and $d'f'h'$ after this load is resisted. The stress in the brake bf is $-R_c$ pounds, and that in the cantilever ribs ae or cg is $\frac{1}{2} + \frac{1}{2}R_c$ pounds.

Let

Δ_c = Elastic deformation of the brake under stress $R_c = \delta_c R_c$ inches;

Δ_1 = Deflections of the pin abc under load R_c pounds $= \delta_1 R_c$ inches;

Δ = Deflection of the point f' from its unstressed position f;

Δ_0 = Elastic deformation of cantilever ribs ae or cg under stress of $\frac{1}{2} + \frac{1}{2}R_c$ pounds $= \delta_0 (\frac{1}{2} + \frac{1}{2}R_c)$ inches;

Δ_2 = Deflection of the point g' from the point f'.

The deflection δ_2 is equal to that resulting from a loading as shown in Fig. 5, plus a deflection, equal to δ_1, from a 1-lb. load applied at the center of a span eg.

Δ_2 is caused by a loading as shown in Fig. 5, giving deflection of $\delta_2 - \delta_1$, minus the deflection, from a loading as shown in Fig. 6, equal to $\delta_1 R_c$. Therefore

$$\Delta_2 = \delta_2 - \delta_1 - \delta_1 R_c$$

From Fig. 4 it is seen that

$$\Delta = \Delta_2 - \Delta_0$$

and

$$\Delta = \Delta_1 + \Delta_c$$

Therefore,

$$\Delta_1 + \Delta_c = \Delta_2 - \Delta_0$$

or substituting the values given previously,

$$\delta_1 R_c + \delta_c R_c = \delta_2 - \delta_1 - \delta_1 R_c - \tfrac{1}{2}\delta_0 - \tfrac{1}{2}\delta_0 R_c$$

$$R_c = \frac{\delta_2 - \delta_1 - \frac{1}{2}\delta_0}{2\delta_1 + \delta_c + \frac{1}{2}\delta_0} \qquad (1)$$

The sectional area of the cantilever ribs *ae* and *cg* is equal to 94 sq.in., and that of the brake *bf* is 151 sq.in. Then

$$\delta_1 = \frac{Wl^3}{48EI} = 5.35 \times 10^{-8}\ in.$$

$$\delta_c = \frac{Wl}{AE} = 0.55 \times 10^{-8}\ in.$$

$$\delta_0 = \frac{Wl}{AE} = 0.90 \times 10^{-8}\ in.$$

where

I = Moment of inertia;
l = Length;
A = Area of the member considered;
E = Modulus of elasticity of the material 29,500,000 lb. per sq.in.;
W = 1 lb.

$$\delta_2 = \int_0^{19} \frac{Mx\,dx}{EI} \qquad \text{(See Fig. 7)}$$

Taking the origin of coördination at O, $M = 2 + \frac{1}{2}x$. Then

$$\delta_2 = \frac{1}{EI}\int_0^{19''} 2x\,dx + \tfrac{1}{2}x^2\,dx$$

$$= \frac{1}{EI}[x^2 + \tfrac{1}{6}x^3]_0^{19''}$$

$$= 7.05 \times 10^{-8}\ in.$$

Substituting these values in equation (1),

$$R_c = \frac{(7.05 - 5.35 - 0.45) \times 10^{-8}}{(10.7 + 0.55 + 0.45) \times 10^{-8}} = 0.105\ lb.$$

That is, if when the pin *dfh* comes to a bearing at the points e' and g', a ½-lb. additional load is applied at each of the points d and h, the reduction in the brake load of 250,000 lb. amounts to 0.105 lb. When the full additional load of 726,000 — 250,000 = 476,000 lb. is applied, the reduction in the brake load is 476,000 × 0.105 = 50,000 lb.; and the final brake stress is then 250,000 — 50,000 = 200,000 lb. compression.

The change in stress in the brake from 250,000 lb., after the pin has come to a bearing at the points e' and g' and the total force of 726,000 lb. is resisted, can also be found by using the theory of the continuous beam with yielding supports. This change in stress is due to the application of the force of 726,000 — 250,000 lb. = 476,000 lb. The loads and unknown reactions for this case are as shown in Fig. 8.

Let the influence calculations for R_c be first made for a 1-lb. load at each of the points d and h. The formula (see "Modern Framed Structures," by Johnson, Bryan and Turneaure, Part II, page 19) for the continuous beam with yielding supports, for this case, reduces to (see Fig. 9)

$$M_e l_1 + 4M_f l_1 + M_g l_1 = 12EI\left(\frac{h_1 - h_2}{l_1}\right) \qquad (6)$$

$$M_e = M_g = 4\ in.\text{-}lb.$$

$$M_f = 4 + 19 - 19R_o = 23 - 19R_o$$

$$2R_o - R_c = 2$$

$$R_c = 2(R_o - 1)$$

Yielding of support e or g equals

$$h_1 = +R_o \times 0.90 \times 10^{-8}$$

Yielding of support f equals

$$h_2 = -R_c\,(0.55 \times 10^{-8} + 5.35 \times 10^{-8})$$

Substituting these values in equation (6), it becomes

$$76\,(2 + 23 - 19R_o) = \frac{12 \times 29.5 \times 10^6 \times 720}{19}$$

$$\times\,(R_o \times 0.90 \times 10^{-8} + 11.8 \times 10^{-8} R_o - 11.8 \times 10^{-8})$$

from which R_o = 1.105 lb.; R_c = 2(1.105 — 1) = 0.21 lb. for 1 lb. at each of the points d and h. R_c for 238,000 lb. at each of the points d and h is equal to 238,000 × 0.21 = 50,000 lb.

This 50,000 lb. is the reduction in the primary brake stress of 250,000 lb., which takes place as soon as the total force of 726,000 lb. is resisted. The final brake stress is therefore 250,000 — 50,000 lb. = 200,000 lb., the same result as obtained in the first solution.

Must Keep Dwellings and Yards Clean Under Proposed Building Code

A state-wide building code for Pennsylvania, drawn up recently by a commission originally appointed by Governor Tener, contains among its radical provisions a clause making it incumbent on everybody to keep his house and yard clean. The clause is written into both the section referring to dwellings built after passage of the act ("hereafter erected") and all existing dwellings ("prior erected"). One of the two clauses reads:

a. It shall be the duty of each family occupying buildings of class IIIc [dwelling houses] hereafter erected to keep that portion of the building or the premises surrounding the building occupied by them exclusively free from all accumulation of dirt, filth, garbage or other refuse.

b. It shall be the duty of the owner to keep all portions of such buildings, or of the premises about such buildings that are occupied or used jointly by more than one family, free from all accumulation of dirt, filth, garbage or other refuse, and it shall be his duty further to report violations of this section to the local board of health or State Department of Health.

c. Any person who shall cause or permit any dirt, filth, garbage or other refuse to be cast into a yard, shaft, court or areaway, in or about any such building, or who shall commit any other nuisance in or about such building, shall be deemed guilty of violating the provisions of this section, and shall be subject to the penalties as herein in this act provided.

The act contains frequent references to the State Department of Health and to local boards of health and requires among other things approval of all plans for all buildings and various forms of permits to be obtained from these bodies in addition to those to be obtained from state or local building authorities. Adding to these duties of the boards of health the supervision over the cleanly condition of houses and yards is likely to put an unprecedented burden of work upon them.

Track Locations at Dayton Complicate a Bridge-Rolling Job

Bridge replacement by rolling the new bridge sidewise into place was so seriously complicated by track conditions in the case of the Dayton Union R.R. bridge that the work had to be done in two stages—rolling it half the distance to put the new track into service and several weeks later rolling it the rest of the way into final position. This bridge, crossing the Great Miami River at Dayton, Ohio, and used by several railways, was washed out by the great 1913 flood, was restored in temporary fashion during the busy weeks that followed and has now finally been replaced in lasting manner by a bridge designed to be proof against future flood effects (note comparative foundations in Fig. 1.) The necessity of maintaining traffic and yet of building the bridge on the old alignment dictated the rolling-in method. Attendant circumstances led to the extra complication of the two-stage move.

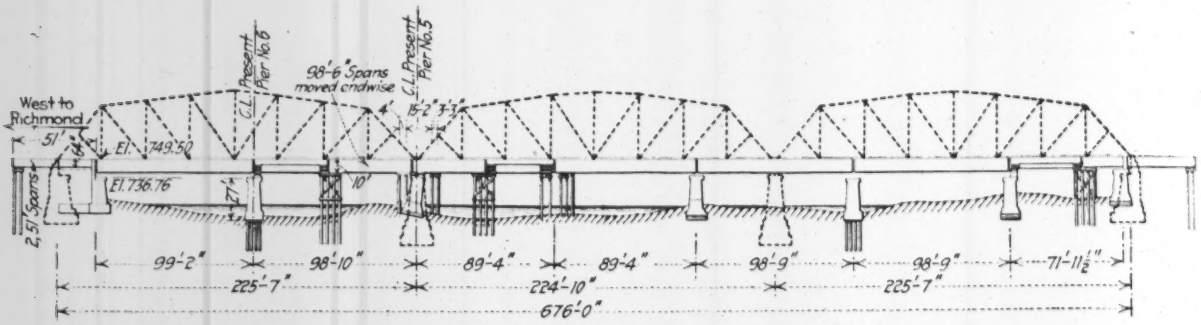


FIG. 1. THE NEW DAYTON UNION R.R. BRIDGE AND ITS PIER AND SPAN CONDITIONS

The old bridge, as restored, rested in part on pile piers and cribs. On this account it was not practicable to roll both old and new bridges, rolling the old one out as the new one came in—the quickest method and one involving no track changes. The old bridge had to be torn out before the new one could be rolled over. Yet, as the Dayton terminal yard begins at the east end of the bridge and buildings border the railway property at the west end, the running tracks could not be deflected over to reach both tracks of the new bridge in its first, or erection, position. One track could be reached by running a spur track from within the yard.

At first this set of conditions appeared to mean single-track operation for some weeks. However, the old bridge being a deck-girder double-track structure, in effect a double bridge, the one-track half adjacent to the new bridge could be torn out, leaving the other old track in service, and the new bridge rolled over halfway, so that both of the new tracks could be put under traffic; then the rest of the old bridge removed and the rolling completed. This proved to be the logical procedure and was adopted.

How Track Conditions Hampered the Work

Conditions were not quite as simple as just indicated. Looking west, endwise at both bridges, their relative positions are sketched in the upper sketch of Fig. 2. The track spacing is 13 ft. on centers in both bridges, but the width of the truss members separated adjoining tracks of the old and new structures to 17½ ft. Therefore, to permit operating after the first move, the approach tracks had to be spread 4½ ft. On account of switches, it was impossible, however, to shift the downstream track by more than 18 in. The upstream pair of girders of the old bridge could be moved outward 2 ft. before reaching the limit of the piers. If this were done, the downstream track would need only 2 ft. shift, and by crowding the clearance somewhat it was possible to reduce this amount to 18 in., solving the difficulty. The extra operation of moving the upstream half of the old bridge was therefore of necessity used.

The set of diagrams in Fig. 2 shows the resulting relationships of tracks. In *A* the new bridge is in its erected position, and both old tracks are untouched and carrying traffic, until traffic is shifted to the tracks indicated in *B* in order to permit the 2-ft. shift of the upstream old girders, whereupon these latter again take

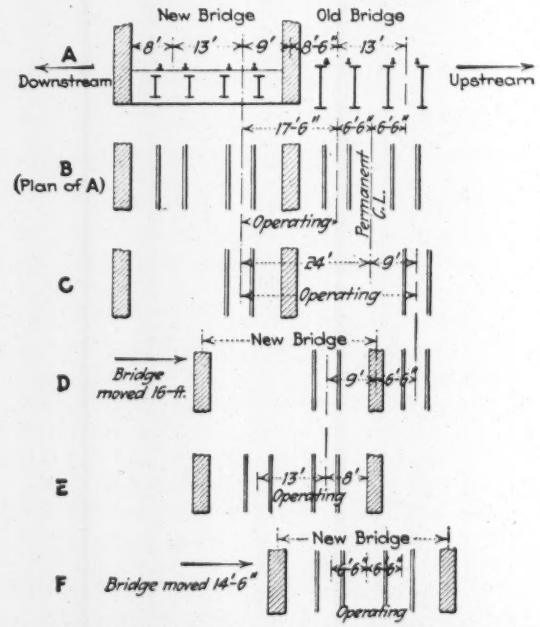


FIG. 2. RELATION OF BRIDGES TO TRACK AT EAST END OF CROSSING

traffic (*C*) for removal of the downstream girders. The result of the first move *D*, indicates the clearances then prevailing; the remaining old track is being removed, and then the second or final move is made, as at *F*.

The program of operations indicated by these sketches was carried out successfully, no hitch of any sort occurring. Erection of the new bridge on its trestle support was completed in November, having been begun about June 1, 1916. Only one span could be erected at a time, as the Miami Conservancy District objected to placing falsework in more than one opening. So soon as one span was swung, the falsework was shifted to the next span. Fig. 3 shows the erection falsework as well as the end supports or rolling falsework.

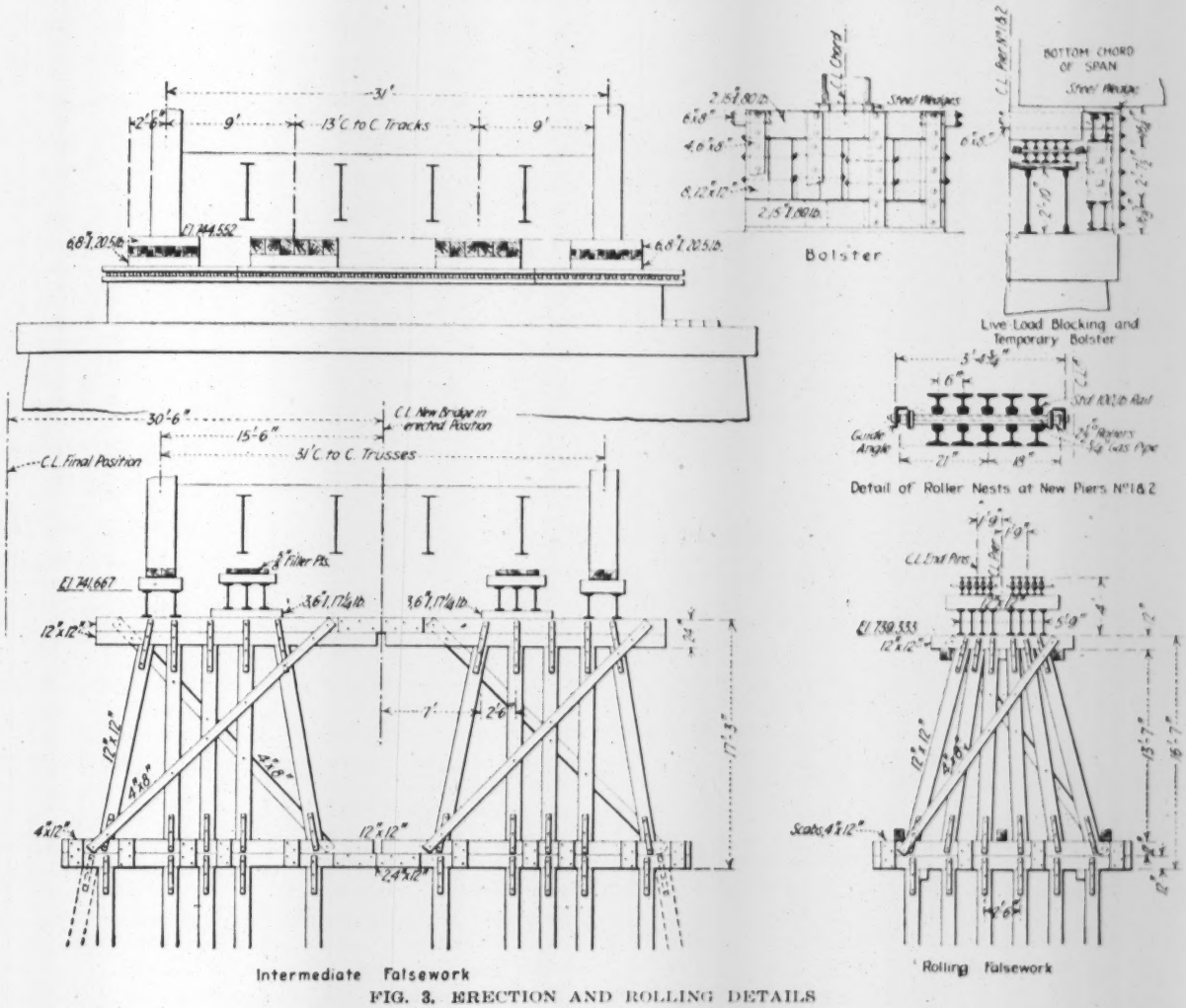


FIG. 3. ERECTION AND ROLLING DETAILS

When traffic could be turned on one track of the new bridge, the upstream old track was taken out of service and its girders were moved 2 ft. upstream. Then traffic was again put on this track, abandoning the downstream old track, and the latter was lifted out span by span by the contractor's derrick car (50 tons' capacity at 50-ft. reach) operating in the same track and taking its load away endwise. This left space for moving the new bridge over. This move was made Dec. 4, in about two minutes' actual moving time. Putting both new tracks in service and taking out the rest of the old bridge occupied some three weeks. On Dec. 27, the second move to final position was made. Within the following week the spans were jacked up, the roller tracks removed and the shoes placed; after clearing away, the contractor was off the job by Jan. 20, 1917.

As the new bridge had to carry trains while still resting on falsework, it was necessary to provide means for distributing the reaction along the length of the end support, since the load was too great for concentrating on a small number of the falsework bents. This was accomplished by blocking at four points under each end of each span, the blocking being placed in such order that two sets of blocking carried the dead-load, and the other two shared in carrying live-load.

Live-Load Blocking and Roller Track

The end floor-beam of a span was originally set on two groups of blocking, approximately under the tracks; and when the span was swung, the entire dead-load reaction of the end came on this blocking. Then two other sets of blocking were inserted under the truss ends, driven in tight so as to be in good bearing, but to carry no material part of the dead-load. Being directly under the trusses, however, these outer blocks would carry practically all the live-load.

This quadruple blocking proved entirely successful. No disarrangement of the blocks occurred during moving, although careful watch was kept for any lifting off. This blocking was proportioned for unit pressures of 400 lb. per sq.in.; 50% higher loading was allowed on the planking, under the roller tracks, to let some crushing occur at any unevenness.

The arrangement of roller tracks was almost identically the same as that used in the same contractor's job of moving the Coshocton bridge on the Panhandle, as described in *Engineering News*, July 15, 1915, p. 105. The pulling rigging was also the same. Two derrick cars set on the center of the middle span, one facing in either direction, handled four lines, one from each abutment or bridge, because the bridge at the end of its move had come with its shoe anchor bolts exactly in line with the anchor bolts through the pier girders. This succeeded so well that there was not ½-in. variation anywhere, and the anchor bolts could be dropped right into the holes.

Jacking Arrangement for Placing Spans on Permanent Shoes

When the bridge was in final position, it was necessary to take out both the blocks and the track and set the shoes. There was very little room on the pier for jacking, however. Temporary bolsters were made to occupy the positions shown by sketch in Fig. 3, and of the construction shown alongside. Setting these up and wedging

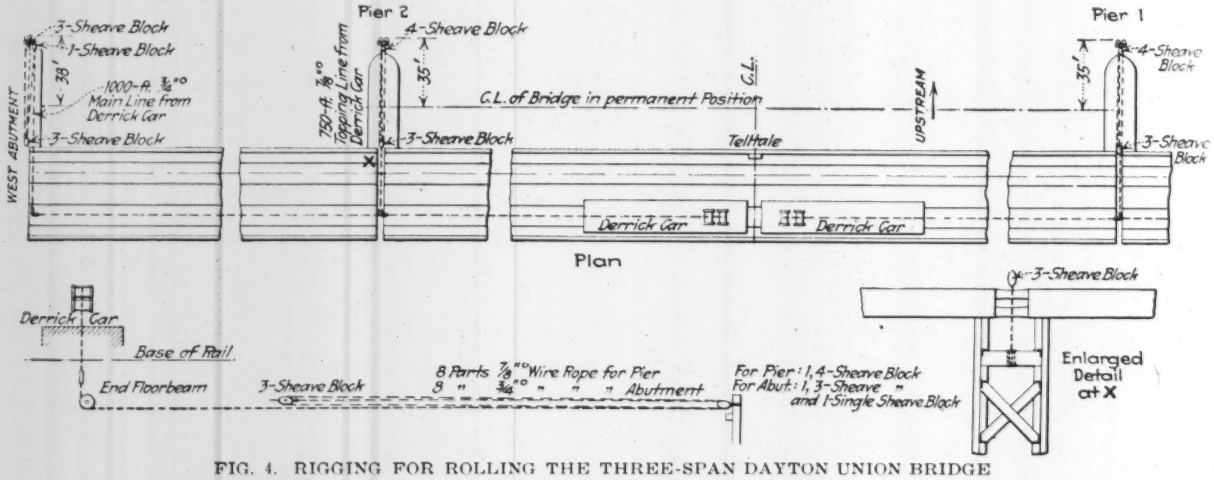


FIG. 4. RIGGING FOR ROLLING THE THREE-SPAN DAYTON UNION BRIDGE

pier, the line running from a hitch to the truss (or the two adjacent trusses) forward to a sheave at the upstream end of the pier, then back to the floor of the new bridge and up to a drum on the hoisting engine. Wires were run from a fastening on the pier to the bridge, and by extensions of metal sash-cord over to an indicator board at the middle of the bridge, carrying here tension weights and pointers on a scale marked on the board, showed at every instance the precise amount of movement on each pier or abutment. At the point fixed for the end of the move, end stops were fixed on the piers and abutments, the bridge to be pulled up tight against these.

Special care was exercised to take off all the rope from each of the four operating drums of the two hoists and rewind so as to have equal wraps on each drum at the start of the pulling. This gave the same pulling speed at all drums when running at the same speed and thereby made it easier to control the four separate hoist drums so as to keep the four moving points exactly abreast. The pulling succeeded so well that at no time in either move was the bridge as much as an inch out of line.

The moving was just as precise with respect to alignment with the direction of the pier girders. The new bridge has longitudinal distributing girders (a girder composed of four plate-girder ribs for the two spans on each pier) running lengthwise of the piers. This construction is adopted by the bridge engineer of the railroad company as a positive means for avoiding concentration of load on the pier masonry. The contractor had to set the pier girders before the move; and great care had to be taken to align them exactly at right angles to the them in place, the outer pair of blocks under the trusses could be split out, transferring their load to the bolsters. The rails of the roller track, both upper and lower, were spliced at points just at the end of the pair of middle blocks, as sketched. When the load on the outer blocks was removed, the outer sections of rails and track could be unbolted and taken out. This left place for sliding in the shoes of the span. The blocking heights were such that the shoes slipped in with 2 in. of vertical clearance. Nothing remained to be done but jack the span, remove the bolsters and the middle blocking and lower onto the shoes, after which the remaining track and roller sections could be taken out.

There was just room enough between the shoe and the middle track section to permit placing jacks. The jacking was done simultaneously for both truss ends on a pier.

The local man in charge of the successful erection and moving operations was H. S. Goodloe, superintendent for the Seaboard Construction Co., of which S. P. Mitchell is president. The work was done under the general direction of J. C. Bland, engineer of bridges, Pennsylvania Lines West of Pittsburgh.

The total moving weight of the three spans with their loading was: Steel of the three spans, 2427 tons; floor, 300 tons; two derrick cars, 180 tons; total, 2907 tons. In accordance with the contractor's regular practice the parts of the moving rig, including the tackle multiplications, etc., were laid out on the basis of three to five times the figures obtained with roller friction at 1%. By this method not only is ample safety secured, but also the speed of moving is reduced to a proper controllable limit.

Minneapolis Has Specially Prepared Industrial District

The experience of Minneapolis, Minn., in stimulating the industrial development of the city, by a prepared industrial district, shows a way for many municipalities to eliminate the existing unsatisfactory conditions.

Many of these cities unhesitatingly offer to desirable industries free sites, bonuses, stock subscriptions and other forms of financial aid as a condition of their location, while other cities employ all the pressure they can command to secure an industry for themselves. This competition has been so severe that many of the stronger concerns seeking locations have avoided civic bodies; weaker concerns, on the other hand, often deliberately seek out civic bodies in order to secure every possible aid.

The Minneapolis project was described by L. H. Brittin, General Manager of the Minneapolis Industrial District, before the annual convention of the Minnesota Surveyors and Engineers Society; the following notes are based on his paper.

The experience of Minneapolis in this field has not been different from that of the average city. About 20 years ago, in its race for industrial development it "bought" some 20 miscellaneous industrial concerns through the donation of free sites, bonuses and stock subscriptions.

Today only one of the original 20 survives and many of the pioneer business men cherish among their old papers an assortment of stock certificates of these defunct "spoiled children." This practice of buying industries evidently tends to develop a type of dependent industry.

There are at the present time in the United States five so-called industrial districts, two of which have been developed by railroad interests to increase tonnage, two by real estate interests as essentially gainful undertakings, and one—the Minneapolis Industrial District—for the sole purpose of stimulating the industrial development of the city. The Minneapolis district is therefore a pioneer in this field.

A municipal industrial district must satisfy several requirements:

1. Such a district must have certain very definite transportation facilities. Its trackage should be part of some "belt line" or "distributing and interchange terminals," as it enables its industries to be served by all railroads without paying a connecting-line switching charge.

2. It should have on its property a "joint freight station," where the manufacturer and distributor can handle both in-bound and out-bound less-than-carload freight for all lines and thus obviate the necessity of draying these shipments to a number of different freight stations.

3. It should be so planned in its arrangement of streets, tracks and terminals that each industry can have its side track parallel to the long axis of its building in order to assure the maximum car capacity in its side track.

4. It should be so planned that the depth of the various sites between street and track will accommodate the types of industries which will locate thereon. An industrial district may be in one of those cities occupying points of natural economic advantage as distributing centers, having say a minimum of 50,000 miles of trackage in a territory in which it has two million people within the zone of second-day freight delivery. Ninety per cent. of the sites in such a district should be so arranged as to accommodate buildings 80 ft. wide with side tracks parallel to the long axis of their buildings—a layout, in other words, that will accommodate branch assembling and distributing plants of eastern manufacturers' concerns. In those cities that occupy a natural economic advantage as manufacturing centers, at least 70% of the sites should not be less than 300 ft. deep from street to track to accommodate groups of buildings of medium sized manufacturing plants.

5. The ideal industrial district should have sub-soil conditions that afford excellent foundations close to the surface.

6. It should be located on a paved arterial street.

7. It should be well served by street-car lines and should have within a zone of 15-min. walk, or 15-min. combined walk and street-car ride, a sufficient population of "native born of foreign parents" or "foreign born" as will meet the requirements of its industries. For example, —a large eastern concern that has been establishing three or four branch manufacturing and distributing plants a year has found it profitable to appropriate for a "labor survey" approximately $10,000 for every $300,000 building erected.

8. The ideal industrial district should impose sufficient building restrictions permanently to safeguard the interests of industries locating on the property.

The history of the development of an Ideal Industrial District for Minneapolis may be outlined as follows: In August, 1914, the business men of the city incorporated under the laws of the state the Minneapolis Industries Association with an authorized capital stock of $300,000. One hundred and fifty-two of the leading business men subscribed an aggregate of $272,000,100, or an average of $1810 each.

In October, 1914, the Association purchased, with the aid of a bond issue, 200 acres of land located on an unimproved arterial street within two miles of the heart of the business center of the city and close to the main line of the Minnesota Transfer Ry.—the distributive and interchange terminal of all railroads entering Minneapolis and St. Paul. In January, 1915, the work of planning the general layout of this property was started.

In September, 1915, a contract was negotiated with the nine railroads owning the Minnesota Transfer Ry. to extend transfer trackage throughout the district, to erect and operate a joint freight station, and to install a railroad yard sufficient to meet the traffic requirements of the property. In December, 1915, the city installed sewer and water throughout the district. In July, 1916, the city paved the arterial thoroughfare connecting the district with the heart of the business section. In January, 1917, the physical development of the district was completed and five industries had been located thereon. Thus in 2½ years from the organization of the corporation the industrial district has become a reality, to a point at least where the promoters are reasonably certain of its ultimate success.

Typhoid Fever in the District of Columbia for the last five years (each ending June 30) were at the following rates per 100,000: 13, 13, 14, 23 and 18, these figures running from latest to earlier. For the 19 years ending June 30, 1916, the average annual typhoid rate was 40.4. The actual number of typhoid deaths in 1915-16 was 47 and the average for the 19 years named was 127.5.

Notes from Field and Office

Wooden truss span 250-ft. long—Moving a concrete culvert on rollers—Floating mixing plant Telpher used on subway construction—Busy yard crane 25 years old

Is This the Longest Span Wooden Bridge?

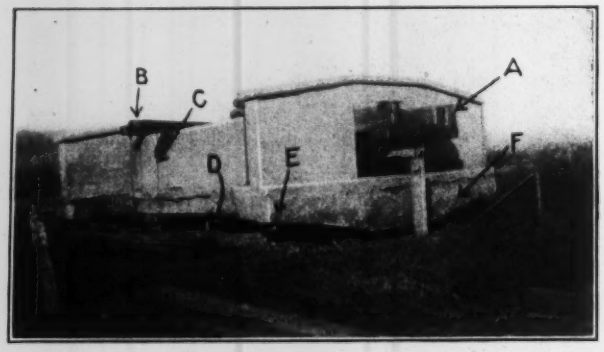
The accompanying views show a bridge at Bridgewater, Rockingham County, Virginia, about 6 miles west of Harrisonburg. It was built in 1877-78 by William H. Grove, a bridge carpenter, and has recently been torn down to

WOODEN BRIDGE OF 250-FT. SPAN NEAR HARRISONBURG, VA.

make way for a modern steel structure. It has a clear span of 250 ft. and had the reputation locally of being the longest wooden bridge in the world.

Moving a Concrete Culvert Intact

A reinforced-concrete box culvert 6 x 4 ft. in section by 24 ft. long and weighing 70 tons has just been moved a distance of 80 rods in Shelby County, Iowa. The accompanying view explains how the box was moved. To



CONCRETE CULVERT JACKED UP AND ON WAY TO NEW LOCATION

lift it from its former site, 4 x 8's 16 to 32 ft. long, indicated at *A*, were thrust lengthwise through the barrel.

To prevent the top from lifting off, sets of timbers *B* were bolted together with long 1-in. bolts or tie-rods *C*. The culvert was started from its bed by twenty-four 20-ton screwjacks *D*. Rollers were slipped under, and the culvert was pulled along by a capstan and horses. F. W. Sarvis, County Engineer, Harlan, calls attention to this job.

Improved Details of Floating Concrete Mixing Plant

By A. W. Kreamer*

In studying the construction of the concrete mixer boat for the Ohio River dam work, described in *Engineering News*, Feb. 1, 1917, p. 169, several details of existing practice were found to be at fault. In the new plant, therefore, the designers made a special effort to improve these details or to eliminate the faults found in other plants. The simplicity of the new designs has

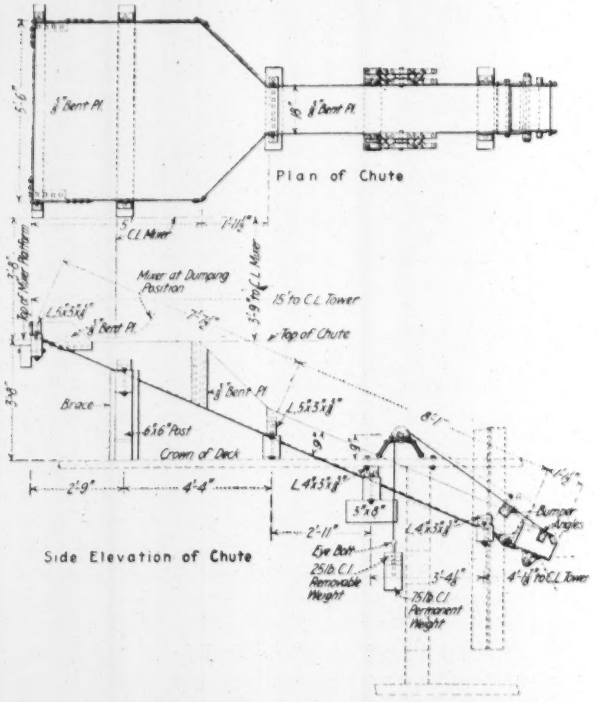


FIG. 1. TILTING CHUTE FEEDING ELEVATOR BUCKET

proved a big feature in their success. While they are applied in this case to a floating mixer plant, there seems to be no reason why they cannot be used easily to advantage on other types of concreting plants. The details may be enumerated as follows:

In tower mixing plants bent guides at the bottom of the towers have caused spill of concrete while the bucket was being started and therefore much valuable time was lost due to sticking and binding of the bucket. At the same time the discharging chute from mixers to buckets causes trouble by allowing concrete to pile up under the bucket while it is up the tower. In the Wheeling plant

*Junior Engineer, United States Engineer Department Wheeling, W. Va.

these difficulties were eliminated by making straight guides for the tower and adding an automatic tilting section to the end of the discharge chute.

Details of this section are shown in Fig. 1. It will be noted that with the addition of two lug angles on the

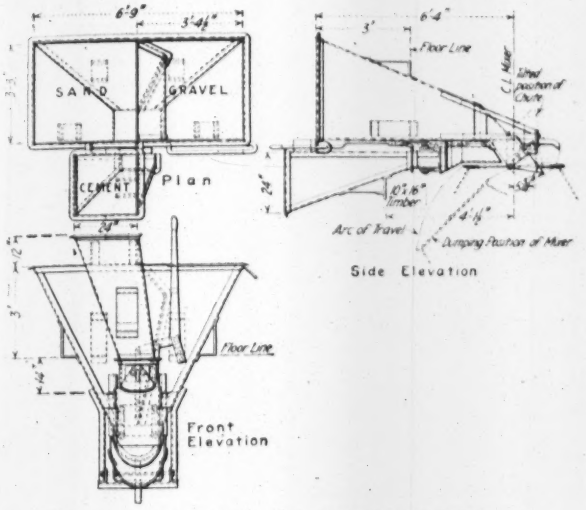


FIG. 2. SECTIONALIZED MIXER HOPPER

bucket the tilting chute is held in its proper open position by engaging with a roller on each side of the chute. As the bucket goes up the tower the tilting part of the chute is pulled into the closed position by two counterweights attached to the outer end of the chute by means of wire ropes that pass over to idler sheaves. As the bucket returns to the bottom of the tower the lug angles again engage with the rollers and pull the tilting chute into the open position. The tilting chute in its closed position, while not watertight, is cement, grout or concrete tight as providing storage capacity of about 2 cu.ft. of concrete that would otherwise mean either spill or loss of time. This enables the hoisting engineer to get a maximum speed out of his bucket, as well as to insure him against spilling of concrete under the bucket when it is not at the bottom of the tower. The arrangement may easily be enlarged upon to provide storage for a full mixer batch.

In some plants the slow discharge of the measuring hoppers into mixers, along with uncertain gaging of quantities, and much trouble from cement dust in getting the cement into the batch have all caused trouble. In the Wheeling plant specially designed hoppers have been provided to alleviate this trouble. Details are shown in Fig. 2. It will be noted that there are three separate compartments for sand, gravel, and cement, respectively, the sloping sides of all of which vary from the vertical to about $6\frac{1}{2}:12$. The arrangement shown is made to work in conjunction with the tilting Smith mixer, making necessary the gravity tilting chute under the hoppers. The sand and gravel hoppers are provided in the field with marker lugs on the inside, thus gaging the quantities as accurately as desired. Because of the handling of the cement in bags, the cement hopper here shown needs no markers. However, such could easily be placed where desired when bulk cement is used. A light wooden partition built at the back of a cement hopper reduces the cement dust trouble to the man at the top of the hopper. The contents of all three hoppers are discharged at one time by the operation of a belt crank lever.

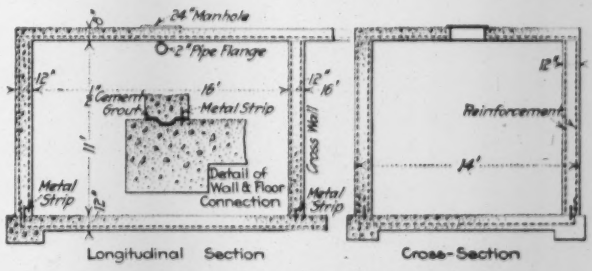
In some plants an inadequate water supply, together with an uncertain measurement of the water, has caused a poor grade of concrete. In the Wheeling plant this was much improved by the provision of a duplex service pump working against the safety relief valve. A quick-opening gate valve and a disk meter with a dial were placed in the water line at a handy position, near the measuring hoppers. The meter dials are graduated from 0 to 100 gal., and have an adjustable pointer which can be quickly set back to 0 after each discharge into the mixer. Thus the water supply can be quickly gaged while the operator may change amounts at will.

In some plants there has been loss of time in changing the inclination of boom, and there has also been no safety device to prevent the fall of the boom should the engineer have trouble with his engine. In the Wheeling plant this is eliminated by the addition of a locking device located near the engine. The line from the engine drum to the locking device may be slacked, thus relieving the strain on the drum shaft. All that is necessary to raise and lower the boom is to start the engine.

Joint in Concrete Oil Tank

A reinforced-concrete oil tank of rectangular shape, for the Charles City Gas Co., at Charles City, Iowa, has a metal cutoff in the joint between walls and floor. The tank is 35 x 14 ft. outside, with 12-in. walls and crosswall, forming two compartments 12 x 16 ft., 11 ft. deep. Its capacity is 30,000 gal. The bottom is a 12-in. slab, with footings under the side and end walls. The roof is an 8-in. slab. All the steel reinforcement consists of sheets of triangular-mesh wire netting, two in each wall and one each in the floor and roof. Each compartment has a 24-in. circular manhole and a 2-in. pipe flange. The tank is entirely underground; and as it is entirely in sandy soil, considerable timbering was necessary.

The floor (with footings) was built first, then the walls and partition and finally the roof slab. In order to make



OIL TANK OF REINFORCED CONCRETE

a tight joint between the floor and the walls, the former was grooved; and while the concrete was soft, a 6-in. strip of galvanized iron was inserted, about 62 in. from the inner face of the wall and about 4 in. above the floor. Laps were made 8 in. long. When everything was ready to begin pouring the walls, the contact surface of the floor was well cleaned and washed with water and then given a $\frac{1}{2}$-in. coat of thick cement grout. The new concrete was placed at once upon the grout. The wall forms were of 6-in. flooring timber nailed to 2 x 6-in. studding spaced 2 ft. c. to c. The wire mesh for the walls was tacked directly to the sheathing of the forms, so as to be about 1 in. from the surfaces. The concrete was a 1:2:3 mix of cement, sand and gravel.

This tank was built by William E. Frudden, of Charles City, Iowa, who has furnished the information. The joint has proved tight, and a second tank is to be erected according to the same general plan.

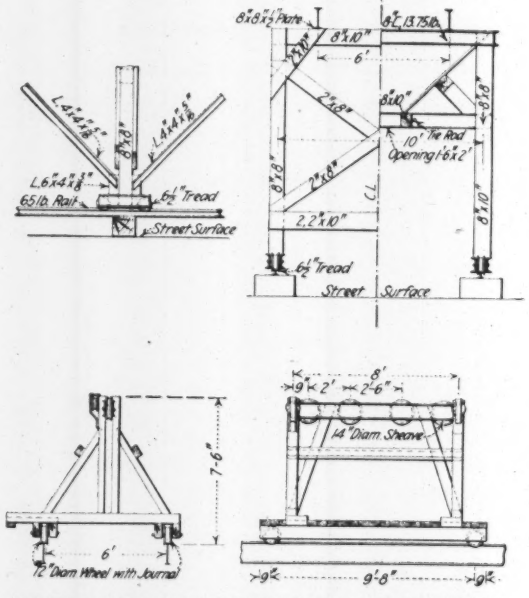
Novel Cableway Hoist and Trolley Used on Subway Excavation

The traveling telpher shown in the accompanying views and sketches has been used by Mason & Hanger-Mac-Arthur Bros., Inc., contractors for Sections 4 and 5 of Route 8, Eastern Subway, 14th St., Brooklyn, N. Y., part of the system of subways now under construction in New York City. The machine is the outcome of studies into the development of cableways for removing the excavated material from cut-and-cover excavation that had to be done without interfering with traffic.

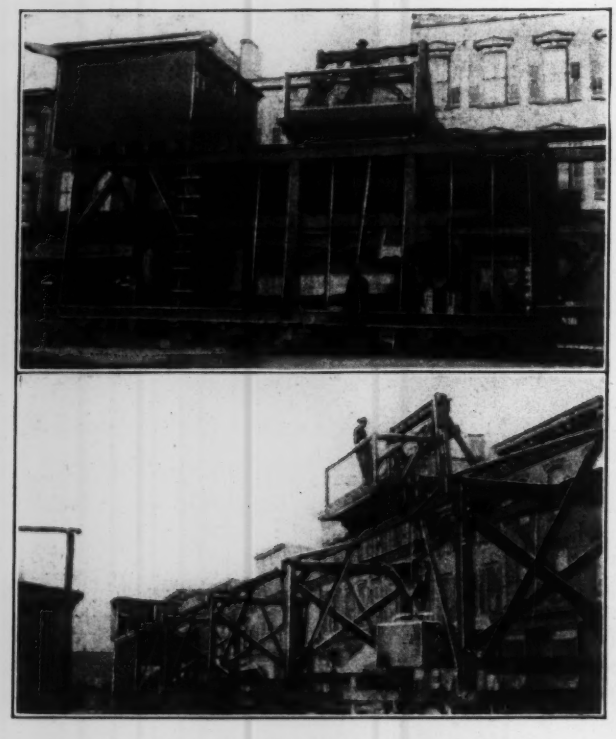
There were many difficulties connected with the use of cableways, not the least among which were the difficulties of moving the heavy towers forward over the cut. The machine developed resembles a cableway in that the bucket carriage runs along under the control of a cableway hoist, but it differs in having the carriage supported on a wood and steel trestle instead of being suspended from a main cable. When the excavation for a given set-up is completed, the trestle is separated into two lengths and pulled ahead 150 ft. to the new set-up by its own power. A complete movement can be made in half a day, counting from the time work is knocked off on the old excavation to the start of the new.

One section of the trestle consists of six spans, made up of a track of 10-in. 25-lb. I-beams 30 ft. long, supported by timber bents and braced by 4 x 4 x $\frac{5}{16}$-in. angles in the vertical plane and $2\frac{1}{2}$ x $2\frac{1}{2}$ x $\frac{1}{4}$-in. angles in the horizontal plane. The timber bents consist of a pair of 8 x 8-in. posts, and 8 x 10-in. cross-cap or plate stiffened by 2 x 8-in. main diagonals, 2 x 10-in. corner diagonals at the top, and a pair of 2 x 10-in. horizontal cross-ties below the main diagonals. Each post rests on a truck formed by a pair of 8-in. $13\frac{3}{4}$-lb. channels supporting a double-flanged wheel, with $6\frac{1}{2}$-in. tread, placed 2 ft. on centers. These trucks rest on 65-lb. rails, supported under the point where each post is to rest by 12 x 12 timber blocks 2 ft. long. No other blocking is used under the rails during excavation or moving forward.

The second section of the trestle is $34\frac{1}{2}$ ft. long and consists of a three-panel bin and one short span of



BENT AND CARRIAGE DETAILS OF TRAVELING TELPHER



TRAVELING TELPHER USED IN BROOKLYN, N. Y.

trestle. The bin is formed by throwing across, between the main posts of the bents, pairs of 8-in. 13.75-lb. channels, with a pair of 8 x 10-in. stringers 2 ft. apart between these. The floor of the bin is of 3 x 8-in. planks, inclined between the stringers and the upper corners of the bents. The middle of the flooring is supported by 8 x 8-in. knee-braces running to 6 x 8-in. middle stringers. Sliding bottom doors (2 x $1\frac{1}{2}$-ft. opening) are operated by long pipe handles. An extra span of the trestle beyond the bin supports the hoisthouse. The outer supports for this are simple 8 x 10-in. posts, with corner diagonals.

All the posts of the four-panel bin section rest on continuous pairs of 8-in. 13.75-lb. channels instead of on the short trucks used under the rest of the trestle. A single wheel is placed 10 in. off the center of each post. After the set-up has been completed, following a movement, the bin and hoist section of the trestle are securely blocked up off the wheels and rails.

In the hoisthouse is a double-drum cableway hoist driven by a 50-hp. 850-r.p.m. three-phase electric motor. Both drums are 24 in. in diameter and 26 in. long between flanges and run at 400 r.p.m. The line for traversing the carriage is continuous, and both ends come off the middle drum, one end going directly to the carriage and the other threading through guide sheaves on the carriage, going over a return sheave at the far end of the trestle and coming back to the carriage for fastening.

The line for lifting the buckets is single; the free end goes over guide and turning sheaves on the carriage and around a single-sheave block attached to the bucket, being finally fastened to the far end of the trestle. Thus a two-part line is secured at the bucket. The drum for this line has a special renewable long-radius flange to ease off the crowding of the rope at the ends of the drum.

In using this machine, the empty 1½-yd. bucket is run out from the bin to some point on the excavation and lowered, when it is exchanged for a loaded bucket, which is brought out from the working breasts on light trucks running on temporary transverse narrow-gage tracks. This bucket is then lifted clear of the trestle and carried over the bin, where it is dumped by tilting. The average performance of this telpher is 150 buckets per working day of 8 hours. The maximum performance has been 260 buckets or 400 yards of excavation brought to the bin.

The machines were designed and assembled by Mason & Hanger-MacArthur Bros., Inc., of which H. B. Hanger is President, John J. Watts, Secretary and Treasurer, and E. A. Groves, Chief Engineer. The hoist was made by S. Flory Manufacturing Co., Bangor, Penn. The buckets were specially made for the contractors by G. L. Stuebner & Co., Long Island City, N. Y.

Cantilever Yard Crane of Historical Interest

A historical piece of contractors' equipment, one of the old Brownhoist cantilever cranes built in 1892 for the Chicago Drainage Canal work, still survives and is in daily use, doing service as yard crane in the shop yard of the Brown Hoisting Machinery Co., Cleveland. The crane is reported to be efficient, besides being historical.

The yard is rectangular, about 300 ft. wide, and the one crane covers its full area, traveling on a track through the middle of the yard. A traveling crane of bridge type would require a number of runways, and as many cranes, while this one machine covers the entire area.

The crane has a trolley travel of about 313 ft., and a clearance height from ground to trolley track of about 50 ft. It is carried by four 4-wheel equalized trucks running on two tracks 37 ft. on centers. The following note on the history of the machine was furnished by the company, at our request:

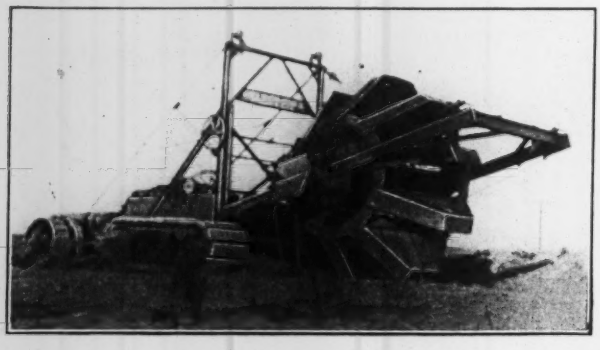
At the start of excavation on the Chicago Drainage Canal it was found to be a very difficult problem to get the spoil from the canal back to the spoil bank. Several methods were tried but they all proved to be very expensive. Finally several of the contractors came to our company with the problem, with the result that the Brownhoist Cantilever Crane was designed and built, the first of its type in the world. There were twelve of them built during the years of 1892 and 1893, and all were placed on this one job with very satisfactory results. This is putting it mildly, because the crane proved to be a huge success in hoisting the excavating material and taking it back to the spoil bank. The material was handled in 3½-ton rock buckets and the crane and trolley were designed for five-ton load. These cranes were like the one shown in the illustration with the exception that the cantilever was inclined 2¾ in. per foot to the horizontal. They had a trolley travel of 343 ft. They were steam operated.

After completion of this work the cranes were returned to the factory and most of them were sold to iron and steel companies throughout the country. In nearly every case the cantilever was placed in horizontal position. Some of the cranes were refitted for electric operation, but generally speaking they are being used today the same as they were on the canal twenty-five years ago. One of the cranes has been used for several years on the Panama Canal and is still being used at Cristobal. Two of them were shipped to foreign countries, one going to Belgium and one to Germany. One of them has been used in the construction of the New York State Barge Canal and one is being used in our storage yard as shown in the picture. It handles sheets, bars and all shapes from the yard to the shop.

CANTILEVER CRANE USED IN MATERIAL YARD

FINE AGGREGATE

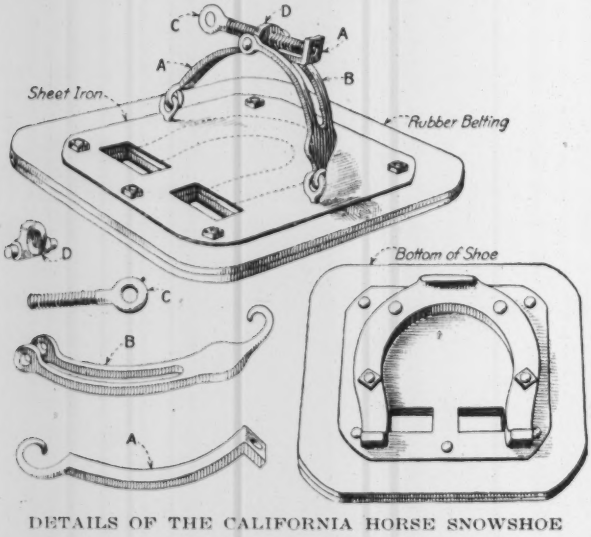
Mechanical Ditching Not Always Cheapest—As an example that ditching machines are not universally economical, the big traction ditcher shown in the view was recently abandoned by its owners after trial on the Cudahy ranch in Imperial Valley, California. The reasons given are that the fuel and labor costs were too high and that the machine was adapted only for land of uniform slope or where the canal line would follow approximately the same grade as the ground surface. The machine was unable to make cuts and fills of



ABANDONED TRACTION DITCHER IN IMPERIAL VALLEY

varying depths, and of course it could make only one size ditch without a complete change of blades. The ditch which this machine was to cut was 3 ft. deep, 3 ft. 3 in. on the bottom and 10 ft. across the top. It was operated by two 25-hp. gasoline engines. It is reported that these ditchers have been used at Valerie, Mont., but in the Imperial Valley mules and fresno scrapers have been found better adapted to local conditions.

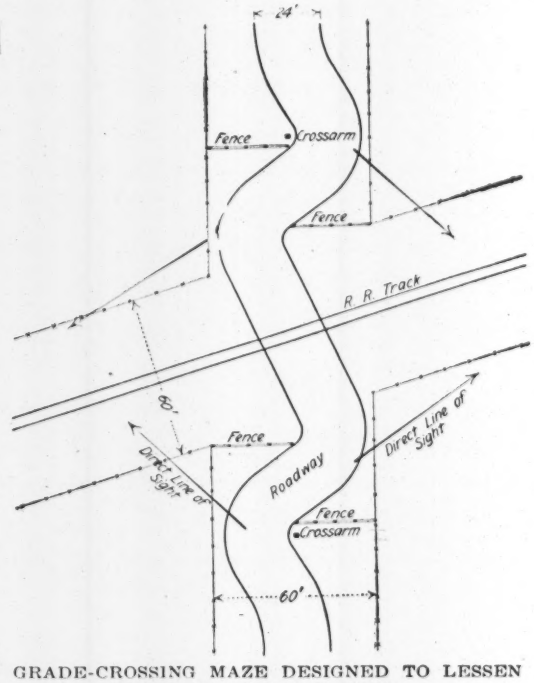
A Horse Snowshoe for use on the soft roads of the Sierra Mountains of California is shown in detail in the sketch. It consists of a plate of sheet iron ¼ in. thick and 9 in. square, with rounded corners. This plate has two 1½-in. rectangular slots cut through it 1½ in. apart, which are for the heel calks to fit in and are made long in order to accommodate horseshoes of different sizes. The shoe is held firmly by a clamp attached to the plate on each side by eye-bolts. Beneath the plate are two thicknesses of five-ply rubber belting 11 in. square, with rounded corners, and underneath the belting is a large horseshoe 9 in. long. Plate, belting and horseshoe are firmly bolted together by ¼-in. bolts and by the eye-bolts.



DETAILS OF THE CALIFORNIA HORSE SNOWSHOE

The clamps are forged out of ⅝-in. flat iron and conform to the shape of the hoof. The swivel bolt fastening the straps together is ¾ in. in diameter by 4 in. long, with a conical end to fit in the bearing hole. S. H. Brockunier, of Nevada City, Calif., who describes this shoe in "Engineering and Mi... Journal," states that the snowfall in the Sierras is usu... quite heavy, but that the temperature is comparatively h... resulting in soft moist snow very difficult to travel over ... horse of steady nerve will learn in half an hour how to tr... on snowshoes. A pair of horses, either in span or tand... wearing snowshoes can cover 4 or 5 miles per hour with ... to 1000 lb. of freight.

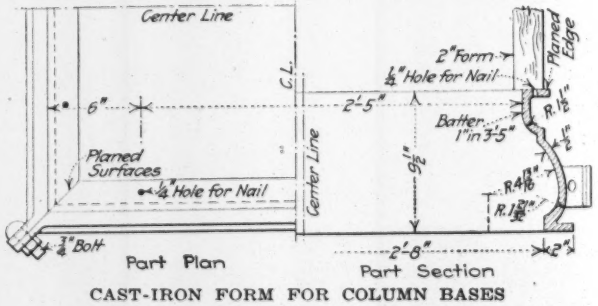
A Scheme To Avoid Grade-Crossing Accidents is propos... by R. G. McMullen, a civil engineer of Portland, Ore. A... illustrated by the accompanying sketch, this scheme consis... of placing obstructions in the roadway in such a manner ... to compel the motor-car driver to slow down and to face bo... up and down the railway track before he crosses the rails. With th's construction at a grade crossing, one approachin... apparently sees the road fenced across, but upon closer view discovers the way around and proceeds at necessarily slow



GRADE-CROSSING MAZE DESIGNED TO LESSEN DANGER OF ACCIDENTS

speed on account of the reverse curves. It is advocated that all wooden fences at the crossing be white and that where stone fences are used a liberal amount of whitewash or white cement be applied. The fences should lap on the line of sight approaching, and the usual railroad crossarms should be one of the center posts, to bring it into more prominence.

Cast-Iron Forms for Column Bases have been adopted on track-elevation work being done by the Chicago, Burlington & Quincy R.R. The subways involve the construction of rows of columns for the intermediate bents. The shafts of the columns are rectangular in section, with chamfered edges, and are made easily in wooden forms. But for the molded bases cast-iron forms are employed, thus simplifying the difficult



CAST-IRON FORM FOR COLUMN BASES

part of the formwork and giving a smooth, even surface to the concrete. The forms, put together with bolts, were designed under the direction of G. A. Haggander, Bridge Engineer, and are made at the company's shops.

Editorials

Not a Terminal, But a Junction Point

The present issue of *Engineering News* is the last which will appear under that name—a name which has been truly a household word to the engineers in America for more than a generation. It is in no sense, however, to be considered as marking the termination of this journal's life. The new journal that will be issued henceforth as its successor, *Engineering News-Record*, will be a continuation of *Engineering News* and of the *Engineering Record* as well, preserving all the policies and traditions and experience that have made the two journals a power for progress in the broad field of civil engineering.

As a matter of convenience in reference, Vol. 77 of *Engineering News* terminates with this issue, and an index to the numbers issued since Jan. 1 accompanies this number. The first issue of *Engineering News-Record*, to appear on Apr. 5, will be Vol. 78, No. 1. This volume will be terminated with the issue of June 28, and thereafter the volumes will extend over six months' periods, as has been customary hitherto on the separate journals.

The trainload of passengers that has been carried forward on the *Engineering News* line will next week be united with the other trainload that has traveled on the *Engineering Record* line, and the journey is to be continued, with motive power and equipment adequate for the greater load and for the new country that is to be traversed.

Public Control of Railway Terminals

For many months the plan of the New York Central to rebuild at great expense its freight line along the Hudson River has been the subject of most active controversy in New York City. To briefly state the case for the benefit of those unfamiliar with local conditions, the freight entrance of the New York Central lines to New York City is over a double-track railway, which leaves the main line at Spuyten Duyvil, at the northern end of Manhattan Island, follows along the shore of the Hudson River at the foot of Riverside Park, and connects with an extensive freight yard at 60th St. From this yard trains are moved to terminal yards farther downtown along tracks laid in 10th and 11th Aves.

These lines have for years been inadequate for the volume of traffic which they have to handle, and public protest against the operation of trains through the city streets has long been active. For many months a contract has been pending between the New York Central company and the city authorities, represented by the Board of Estimate and Apportionment, whereby the company proposes to spend from $50,000,000 to $100,000,000 in elevating its tracks, introducing electric motive power, enlarging its yards, and covering its tracks along park property so that they will not be an objectionable feature.

There is no doubt whatever that the proposed improvement as an extension to the freight-handling facilities of the city is urgently needed. Various prominent business interests, such as the Merchants Association, have been active in support of the project. From the first, however, there has been evident a very large amount of public opposition. A large part of this opposition is influenced by the idea that the work proposed would be a serious injury to New York's famous Riverside Park, both during construction and after completion. There is, however, a more important opposition, which is based on the underlying idea that a great city should control the terminals of both rail and water transportation lines on which its commerce depends. In the public agitation going on in a dozen American cities at the present time over proposed expansion of railway terminals, this is the idea which finds greater and greater prominence.

Public opposition to the New York Central plan was effectively voiced last week in a report made by the Public Service Commission at the request of Governor Whitman, in which the pending contract is strongly opposed. The chief ground of the opposition is that the contract gives to the New York Central not merely a franchise, either for a limited period or for perpetuity, with opportunity to readjust its conditions at certain periods, but absolute ownership rights to its line through the city streets and its connecting terminals.

It is quite within the possibilities that it may at some future time be greatly for the city's interest that the elevated freight line, which the New York Central Ry. proposes to build, should be made available also for the cars and trains of other competing companies. There is obviously no room in the limited space on Manhattan Island to permit the construction of other competing railway lines there. Hence if this line of the New York Central Ry. is constructed, it is believed by many that it should be open to the use of all railways who can at any later date find means of access to it, as might be possible should a bridge be constructed across the Hudson.

The attitude of the Public Service Commission may well be judged by the following excerpt from its report:

> There is involved the public policy of the state that the present and future interests of the state and city, of the general public and of shipping and mercantile interests shall be adequately protected. In granting the right to use public streets and places, the duty devolves upon the municipality to protect public rights. This has usually been accomplished by the grant of franchises for limited periods, or else in perpetuity, with periodic readjustment of compensation, to give the opportunity at stated periods to revalue such public grants. Such franchises in modern form have contained other numerous provisions for public protection. A fine type of these grants are those granted for the Pennsylvania improvement in and through New York City.

Since the report of the Public Service Commission was issued, it has been announced that radical changes and alterations would be made in the contract between the city and the company before its final execution. It is probable, however, that the entire plan will be shelved for the present. Great as is New York City's need for an improvement of the freight terminal facilities on Manhattan Island, those who have given most study to the subject are agreed that no piecemeal development

or development made in the interest of a single corporation can fully serve the needs of the city.

It seems likely that a new movement to have a broad study of transportation facilities for the entire port of New York undertaken by a commission representing both New York and New Jersey may be one factor in bringing about a delay in New York Central's plans until the result of that study can be known. The railway company will hardly object to a certain amount of delay, as it would in any event hardly wish to push work on so extensive an enterprise until prices of labor and material return to somewhere near a normal figure.

Saving Engineers Labor

Every reader of *Engineering News* will be interested in the announcement that work is already under way on a General Index for the volumes of *Engineering News* from Jan. 1, 1910, up to the present issue, a period of seven years and three months. At no previous period in the history of *Engineering News* has such a large amount of permanently valuable matter been published as in the past seven years. When one endeavors to look up the information which has been published in that time on a given subject, he has to search through the separate indexes for each of these fourteen volumes. As it is often necessary to search under three or four different headings in an index to find all the material that has been published on a given subject, it may happen that a search will require looking in fifty or more places in the separate volume indexes. When the searcher has at hand a General Index to all these volumes, the task that would require hours can be accomplished in a few minutes.

By way of illustration, suppose an engineer desires to look up certain information relating to piles and piledriving contained in the volumes of *Engineering News* from 1905 to 1909. By referring to the General Index to these volumes, which was published in 1910, he will find under the headings "piledrivers" and "piledriving" references to a score of articles and under the heading "piles" references to some eighty or more articles. It is an easy matter to look over these references and then turn to the articles bearing on the class of work in which he is particularly interested.

With this book index at hand, a file of bound volumes of *Engineering News* becomes a veritable encyclopedia of current engineering practice. It is in fact superior to any encyclopedia, since it is more up to date and is made up largely of contributions from acknowledged leaders of the profession.

As the older readers of *Engineering News* are aware, the earlier volumes of *Engineering News* were covered by General Indexes published years ago. The first of these books covered the ten-year period from 1890 to 1899 inclusive; and the later books covered the five-year periods from 1900 to 1904 and 1905 to 1909. Those who have used these earlier General Index volumes will fully appreciate the great value to the profession of the new volume covering the years from 1910 to the present time. It is expected to have the new volume completed and ready for distribution before the close of the present year.

It may be here stated also that it is the present intention, at the end of a suitable period, to make the volumes of the new *Engineering News-Record* similarly available for convenient reference by the publication of a General Index. Subscribers, therefore, will have a strong incentive to preserve and bind these volumes for future reference.

We are of course aware that many readers feel unable to keep and file their volumes on account of the difficulty of carrying them about from place to place when they change location, as most young engineers are apt to do frequently. To meet the needs of this class of engineers there should be a file of bound volumes of this journal available for ready reference in every public library.

Many public libraries already possess such files. Where libraries do not have them, it is only because the librarian in charge does not understand the importance and value of the service that a library may render in this way to engineers and to the public.

It is not only the young engineer who cannot carry a file of bound volumes about with him who will benefit from such library files. It not infrequently happens that a consulting engineer may be distant from his office and desire to look up some matter of engineering practice. It may be a matter of great importance to him to be able to go to a public library and refer to a file of bound volumes of *Engineering News* to hunt up certain information.

Readers of *Engineering News* can render a real service to their profession by urging upon those in charge of public libraries in their locality the importance of obtaining and keeping available for reference the back volumes of this journal and a complete file of the new *Engineering News-Record.*

Vanishing Typhoid, with a Bit of Editorial Retrospection

Gratifying evidence of the progress of applied sanitary science and improved public-health administration is afforded by the rapid decline of typhoid fever in the United States and Canada. In years now happily long gone, it was stated again and again in these columns that as a general proposition a city with a typhoid death rate of 20 or more per 100,000 population was evidently suffering from a polluted water-supply.

Doubtless that was largely true, but later advances in the knowledge of typhoid warrant the conclusion that public water-supplies then got more than their due share of the blame for typhoid fever. However that may have been, typhoid began to decrease with the substitution of naturally purer or artificially purified sources of water-supply for grossly polluted ones. It decreased still more when health boards began to get effective sanitary control of milk supplies and of other foods subject to pollution by typhoid discharges.

Hypochlorite treatment and later liquid chlorine, combined with the growing (though as yet generally inadequate) state and local sanitary control of water supplies, have gone far toward eliminating the typhoid germ from drinking water. With the heavy decline in typhoid cases through water-supply and other sanitary improvements, better health administration, better medical treatment and more and better trained nursing there are of course fewer typhoid germs set loose to pollute water, milk and other foods, for hand-to-mouth infection.

New York City in 1916, to cite the record of a single city, had an annual typhoid death rate of only 4 per 100,000. This was a decline from a rate of 12 no further back than 1910 and 1911, and from 6 in both 1914 and 1915. In typhoid deaths the decline was from 558 in 1910 to 215 in 1916 and in cases from 3582 to 1617. If the comparison were to be carried further back, it would of course be even more notable.

In this, its last issue under the present title, perhaps *Engineering News* may be excused for saying that it feels it has had some part in bringing the typhoid scourge well down toward the vanishing point. Twenty-five years ago (Apr. 21, 1892) there was published in *Engineering News* an epoch-making paper entitled "Typhoid Fever in Chicago," by Prof. William T. Sedgwick and Allen Hazen. The paper had been read at Boston, on the previous Jan. 22, before the American Statistical Association. It was a veritable "Lochiel's Warning" to Chicago and the world against the typhoid danger from the Chicago water-supply, incident to the approaching World's Fair at Chicago in 1893. That the warning was needed no one now will deny in view of the fact that the typhoid fever death rate for Chicago was 166 per 100,000 in 1891 and during the previous ten years had ranged from 47 to 105.

There had been, if not an attempt to suppress the paper just mentioned, no effort to give it the widespread publicity it deserved. A junior member of the editorial staff of *Engineering News*, backed by the late A. M. Wellington, then in the prime of his brilliant editorial career, went to Boston, met Professor Sedgwick for the first time, received in a never-to-be-forgotten hour his first real knowledge of the scientific relation between water-supply and typhoid fever, secured the paper on "Typhoid in Chicago," with permission to publish it, and hastened back to New York and made it ready for *Engineering News* of Apr. 21, 1892. The paper, as might be expected from its authorship, was a masterly array of facts and conclusions. By means of tables, diagrams and text forceful comparison was made of typhoid cases and deaths in Chicago, New York, Philadelphia, Boston and various foreign cities. By these means and by telling extracts from official reports, Chicago's long-recognized need for relief from a typhoid-infected water-supply was shown beyond dispute.

The publication of this paper had a profound and widespread effect, in Chicago and throughout the United States. From that date to this *Engineering News* has spared neither pains nor space in collecting, presenting and interpreting data showing the connection between polluted water and typhoid and how the danger can be overcome by legislation, improved sanitary administration, and particularly by the installation and efficient operation of water-purification plants. This is of course only a small part of its fight against sanitary and other evils in the domain of engineering. The whole program will be continued onward from Apr. 5 next in *Engineering News-Record*.

A New Departure in Advertising

The fact that the business aspect of the advertising pages of a modern technical journal is not allowed to exert an influence on editorial effort, does not preclude the editors taking a keen interest in what is advertised and how. And when is seen as novel and useful a departure as is found in this issue of *Engineering News* comment here is proper and natural.

Coöperation in advertising has been considered by many minds, and schemes more or less resembling the Buffalo Power Station group of pages have been proposed. But it has remained for Mr. Barrett Smith to coördinate and unite the publicity efforts of many who contributed to the successful completion of this great steam plant. The reader's interest in each page is greater, because of its association in the group, than the same space and display promiscuously inserted. The extension of the scheme is inevitable.

Notice to Subscribers

The consolidated Engineering News-Record will be sent to all subscribers of both Engineering News and Engineering Record for the full unexpired terms of their present subscriptions. Subscribers to both papers will receive Engineering News-Record for the **combined** unexpired terms of subscriptions to both papers.

For instance, if you have five months due you on Engineering News and six months due you on Engineering Record, you will receive the Engineering News-Record for eleven months before a renewal is necessary.

Letters to the Editor

Water Rights and Common Law

Sir—The communication of H. B. Sweet in "Engineering News" of Mar. 22 contains a note of protest whose parallel might be found among the letters of the leading engineers of India, northern Italy, France and Spain, 50 or 75 years ago. While the court cases referred to by Mr. Sweet may furnish opportunity for the engineer to discredit himself, yet it seems to me that these controversies should encourage him to compare the procedure under our court domination with that which has been adopted in many foreign countries where the English common law has not been accepted.

As I view it, the fundamental trouble is not with the engineer. With us, water rights are determined by court decree rather than by officers or boards having technical qualifications. Under the common law we have nothing but theories which have been inherited from a country which is but slowly overcoming feudal influence. The common law as applied to water resources was not intended to protect the many private and public uses of water common in this country. It developed as the English House of Lords promulgated rules and regulations for the protection of the great landlords of that country.

Our courts have not made a record in this kind of work to which they can point with pride. They begin with a mistaken theory, and every case brings to light new questions which cannot be definitely decided. This condition always results where the few fundamental principles relating to the administration of water resources are ignored. In every civilized country, with the possible exception of England and the large majority of our states, water resources are administered under laws which embody wise principles, rather than by court decree based on a single, impossible doctrine. Even the English colonies, with the possible exception of eastern Canada, which has been influenced by the practice here, have abrogated the common law in this particular. Our mistake, fundamentally, is that we have not provided the necessary laws and machinery to support an adequate department for this kind of work. In the absence of these, an appeal must be made to the courts. Under this careless system, we have obliged the courts to enter the field of administration and, in dealing with the common law, they must also become legislators.

I agree with Mr. Sweet in so far as he goes. Engineers will never be satisfied with the kind of stream administration that is now afforded by many of our states. After engineers have been actively engaged in the administration of water resources for a term of years, they are naturally distressed when obliged to give testimony in a court which relies upon the common-law doctrine. It is a shock to such engineers to find the court building up theories which have no foundation in justice or reason and which never lead to an equitable decision.

It is possible that engineers should be criticized because their testimony in these cases is not of the kind to bring harmony. It might improve matters if each court were to employ an engineer and rely upon him for technical advice. But the real trouble is more deeply seated. Ample proof of this is found in the published court decisions. If courts agreed, there would be some cause for feeling that they had at least touched upon one of the fundamental and necessary principles at some point. We will have no relief until the reform extends far beyond the field immediately influenced by the engineer who acts as an expert witness.

CLARENCE T. JOHNSTON.

Ann Arbor, Mich., Mar. 24, 1917.

Reinforced-Concrete Patents Defended

Sir—In your issue of Dec. 28, 1916, on page 1240, in an editorial reply to Mr. Haynes, you say "it is against public policy and unprofessional" for the engineer "to claim a monopoly in his solution of such a problem unless he has really made an important advance in the state of the art."

I am convinced that your journal is mistaken in the general view it has given to its readers as to validity of patents in reinforced-concrete structures. At the present time seven patents on structural improvements in reinforced concrete have been held valid by United States Circuit Courts of Appeals, the final authorities in patent matters. They are the Norcross (219 Fed., 188), Bone (221 Fed., 944), Thacher (210 Fed., 909, 234 Fed., 640), Ransome (201 Fed., 528), Ferguson (236 Fed., 924), Hennebique (163 Fed., 300), and Nolte (206 Fed., 666) patents. Only one, the Turner (211 Fed., 466) patent, has been held invalid in a higher court. The references are to the number of the "Federal Reporter" and page, so that the above statement can be confirmed in any law office.

In each of these cases the defense of mere mechanical skill was a part of the attack upon the patent, as it is in every defense, for it is part of the standard answer in defense of any infringement suit and is given as one of the defenses in all textbooks on patent law.

Recently several lower-court decisions have been rendered adverse to structural patents in reinforced concrete, but these decisions are all pending appeal to the higher court. In nearly every case these patents have been held invalid in lower court upon technical interpretations of disclosures found after years of search in rare technical journals not known to the engineering profession in this country. With the exception of the Ferguson patent, I know of very little in the art thus far disclosed to anticipate properly any of the other reinforced-concrete patents now in controversy in the courts.

An illuminating parallel for reinforced concrete is the Grant rubber-tire patent held valid by the United States Supreme Court in 1911 (220 U. S., 428). The rubber tire for vehicle wheels is molded as a plastic and reinforced with two wires longitudinally to hold it to its seat between the two flanges of the felloe. The old forms known to the art had square or inclosing flanges to hold the tire from being dislodged. The new Grant tire had outwardly inclined flanges, permitting the tire to be unseated on striking a side obstruction, but relying on the two reinforcing wires to bring it back to place.

Does this represent any greater advance in the art than most of the patents on reinforced concrete that you have been criticizing? Suppose we attenuate an arch of molded plastic until tension occurs at either edge upon application of a live load and then reinforce each edge with steel bars to bring the arch back to place when deformed by such loads; is it not on all fours with the rubber tire? On the Supreme Court decision in the rubber-tire case the owners of the Grant patent took judgment for more than $600,000.

The opposition of the civil-engineering profession is not to paper patents, but to successful patents, to patents that have developed the art and that have proved effective in excluding others, which are the fundamental reasons for the patent system. The Cameron septic-process patent and the Warren bitulithic-pavement patent are examples; both of them have stood the final test of invention and validity.

Indianapolis, Feb. 9, 1917. DANIEL B. LUTEN.

The Future of Mattamuskeet

Sir—I have read with interest the articles and editorial notes in "Engineering News" of Mar. 1, relating to the drainage of Mattamuskeet Lake, in Hyde County, North Carolina. I think you did not sufficiently emphasize the fact that the plans are for the future and that this district does not show a project completed and in good shape. As I was over the project in an advisory capacity in February, I feel that I may well set forth the facts to date.

There is no doubt in my mind that the drainage project can and will be worked out to final success. The smooth level land is there, the rich soil is there, the difficulties to be encountered are not extremely unusual or insurmountable. The plans for drainage are well designed. The pumping plant is well constructed and capable of handling the water, as now, more rapidly than it can reach the plant; without going into the matter of calculations, I think it would be capable of discharging more than ½-in. rainfall per 24 hours from the whole tributary lands. Having spent two nights at the New Holland Inn, I have nothing but praise for its rooms, cuisine and management.

But it is apparent that the management of the district affairs has not been all that could be desired. There has been a delay of 17 months or more in completing the dredg-

ing, which does not seem warranted, although we must bear in mind the attendant circumstances, the difficulties of financing such operations, the long routes of transportation into the locality, etc.

The only work done in 17 months on canals or levees is that a "walking dredge" has been purchased to clean out the ditches, and it had gone some few hundred feet up the main canal from the pumping plant when I was down there. This machine was a 1- or 1½-yd. clamshell dipper dredge, operating on a turntable and "walking" along upon one berm of the ditch. It was not then operating as successfully as desired and, in my opinion, is not the best type of machine for this purpose.

The main outlet canal, main interior canals and laterals, such of them as I could see and examine within the three days at my disposal, are badly filled with silt. The main canals have been completed for about two years and in places have silted up as much as from 3 to 5 ft. The outlet canal, designed for navigation, having a bascule or lift bridge over it at one point, was so badly filled as to have only about 2 ft. depth of water at some places and, I was informed, was not navigable for coal barges, except under favorable conditions of wind and tide.

I noticed also that the canals are not all completed, nor yet all the boundary levees. In fact, on Feb. 6, 1917, there yet remained 485,518 cu.yd. of excavation to be made to complete the original contract, and through somebody's fault or blundering two small dipper dredges capable of completing the work in six or eight months were then lying idle and rusting out, and have been so for about 17 months past, while they ought to have been at work and the project completed. Also, the ditches have probably silted up more as a result of idleness and delay than they would have done if the work had been expedited.

Litigation on the work has been settled, and arrangements are said to have been made to go on with the dredging to completion and also for redredging such parts of the canals as have become badly silted. The need for redredging work so quickly after the original construction might lead one to doubt the feasibility of maintaining these ditches without great cost. But if the soil is as productive as I am led to believe it is from what I have seen of it, the owners will be justified in any reasonable expenditure of money for maintenance. In fact, in most of the river districts along the Mississippi and Illinois Rivers the same or similar conditions of siltage prevail, and it is found from actual experience that those lands are justified in spending as much as $20 to $30 per acre for the original construction and from $1 to $3 per acre per annum for maintenance. Also, experience has taught that, with a good recleaning of the ditches within four or five years after their original construction, the annual cost of maintenance and the need for redredging become less and less, due to the ditches assuming their natural slopes and permanent banks, and to other causes.

Further, as to soil and land values, I feel certain that the soils in Mattamuskeet Lake and vicinity are all that have been claimed for them. I saw samples of various crops grown upon a small experimental tract within the lake bed (leveed off by a dike not over 4 ft. high, with a small pump to care for the surplus water). These would be considered extremely good, even if grown upon the best farm lands of Illinois or Iowa. Among the crops thus grown were cotton stalks 7 ft. high, yellow dent corn with ears 10¾ in. long, white corn with ears nearly or quite a foot long, also a variety of prolific corn, one stalk of which bore five ears and many stalks of which had three ears, but of course not so large as those named.

Other crops observed and grown here were vegetables of a most luxurious kind—potatoes, sweet potatoes, yams, pumpkins and the like, looking as fine as you would see anywhere at a state-fair exhibit. Also, there was a great variety of grains, forage crops, etc. There is no question as to the fertility of that soil. It is similar to the silt soils upon all our great river valleys. The lands surrounding the lake have been in cultivation, some of them, for over 200 years and are still growing fine crops of cotton and corn wherever the land is a foot or two higher than mean tide. It is a curious fact that the highest lands around this lake seldom attain a height of 10 ft. above sea level, and the greater part of the county is less than 5 ft. above.

J. W. DAPPERT.

Taylorville, Ill., Mar. 6, 1917.

[In justice to the Mattamuskeet Drainage Commission, it should be stated that the responsibility for the delay in completing the ditches and levees does not superficially appear to rest entirely on the commissioners. There has been some litigation over priority of securities, and there seems to have been a lack of close coöperation with the dredging contractors. It may be inferred, from the harmony and dispatch with which the pumping station was completed (by another contractor) that some share of the blame may rest on the ditch contractor.—Editor.]

Advisability of Using Old Macadam as a Pavement Foundation

Sir—As Warren Brothers Co. and I personally have taken the initiative (beginning in Boston with the laying of bitulithic pavement on Dartmouth St. in 1903) on the positive affirmative side of this question, and as we have claimed and proved by long practical experience that old macadam forms a most superior foundation for a resilient and stable bituminous wearing surface, it seems proper that I should reply to the article in your issue of Feb. 1 by W. S. Anderson on this subject.

Mr. Anderson builds a "man of straw" and asks how to proceed when the width of new roadway exceeds the width of old macadam, a condition which very seldom arises. He then relates the dire consequences of cracks and paints a word picture of those fearful cracks along the line of the joint between the new and the old macadam base.

Mr. Anderson then proceeds to knock down his "man of straw" by saying, "To eliminate cracks, the subgrade must be made uniform in character by scarifying and loosening the old macadam foundation and by a uniform respreading and rolling of the excavated material over the subgrade. Such a procedure does not necessarily insure a uniformly compacted subgrade, but approaches it within practical limits."

Having worked himself on through a series of other direful objections to the economic salvage of millions of dollars already invested in macadam by utilizing it as foundations for new, stable, resilient bituminous surfaces, he takes more courage by way of advocating the economically unpractical rule, "the macadam should in all cases (of side fill more than a foot deep) be loosened or scarified to a depth of not less than one foot."

Mr. Anderson may be surprised when I suggest that if such a condition ever exists, just increase the width of the road by a foundation of new concrete, under which condition the undisturbed old macadam base in the old roadway will not settle and of course the new concrete base at the increased width at the sides will not settle and we will have the desired condition, a foundation which will not break up because of unequal settlement.

GEORGE C. WARREN.

Boston, Mass., Mar. 13, 1917.

Welding the Schenectady Pipe

Sir—I desire to present the following paragraphs as an accurate statement of conditions under which the welding of the Schenectady lock-bar pipe has to be done (as noted in "Engineering News," Mar. 1, 1917, p. 374) to correct some evident misunderstandings.

About half of the 10,000 ft. of this line is laid in swampy ground which is wet all the time, so that excavation cannot be eliminated as your report stated. I have walked over the entire line and inspected the pipe for some distance inside; I estimated that 15 joints would have to be welded inside (under highways, etc.). The remainder of the joints, in my judgment, could best be welded on the outside, since the pipe is coated inside as well as outside, to prevent rusting; and the fumes of this combustible material, together with the gases from any welding operation, will be difficult to remove in a 36-in. pipe with manholes 750 ft. apart. I believe it would be cheaper in the end to excavate around the joints—even if it should prove practical to weld in swampy locations without excavation.

The leakage test provided in the specifications is all right so far as it goes; but it does not locate leaks, and a small covered leak will rapidly cut a hole in the pipe.

The Rochester Welding Works made experimental welds on both inside and outside of this pipe; these were done under very unsatisfactory conditions, but showed the possibility of using the oxyacetylene process. My own experience in such work and in all kinds of oxyacetylene welding has been sufficient to enable me to bid without any fear that this contract could not be satisfactorily completed with this method. A far larger job was successful in 1910-11 at Boulder, Colo.; at the lower end of the pipe the sheet was 1¾ in. thick and carried a pressure of 825 lb. per square inch.

Perhaps I ought to state out of fairness that the Schenectady Board of Contract and Supply had a representative of the General Electric Co., which employs both processes in its works, testify in the presence of bidders that a better job could be secured by inside welding electrically done.

S. W. MILLER.

Rochester Welding Works, Rochester, N. Y., Mar. 5, 1917.

New Columbia River Interstate Bridge Remarkable for Its Length

By Frank M. Cortelyou*

The Interstate Bridge over the Columbia River between Portland, Ore., and Vancouver, Wash., has a total length of about 23,000 ft., including all its approaches. At the Vancouver end approaches are provided on Washington St. and from Main St. by way of First St.; each approach is about 300 ft. long. The structure over the main channel of the river is 3530 ft. long, consisting of ten 265½-ft. truss spans, three 275-ft. truss spans, and one 50-ft. girder span. One of the 275-ft. spans is a vertical-lift draw which can be raised to give 150 ft. clearance above ordinary high water.

To the south of this bridge Hayden Island is crossed on an embankment 1480 ft. long, and the Oregon Slough by a plate-girder bridge 1140 ft. long, consisting of 11 spans. From the south side of Oregon Slough there are two approaches, one about 10,800 ft. long connecting to Union Ave., and the other about 5800 ft. long connecting to Derby St., Portland. These approaches are on embankments averaging about 24 ft. in height, with the exception of a four-span plate-girder bridge 307 ft. long over Columbia Slough in the Union Ave. approach.

*Resident Engineer for Harrington, Howard & Ash, Consulting Engineers, Kansas City, Mo.

FIG. 1. CHANNEL END OF INTERSTATE BRIDGE

The bridge provides a roadway 38 ft. wide from Vancouver to the south side of Oregon Slough. From this point to Portland a 30-ft. roadway is provided on the Union Ave. approach and an 18-ft. roadway on the Derby St. approach. On the steel portions there is also provided a sidewalk, 4½ ft. wide on the truss spans and 5 ft. wide on the girder spans. Provision is also made for the future addition of a sidewalk on the approaches south of Oregon Slough.

Six lines of rail are provided on all the steel bridges, for double-track electric railways, both, standard- and narrow-gage.

The Vancouver approaches contain 25,000 cu.yd. of sand, the embankment over Hayden Island 105,000 cu.yd., the Union Ave. approach 820,000 cu.yd. and the Derby St. approach 515,000 cu.yd., making a total of 1,465,000 cu.yd. in all embankments.

The piers for all three bridges are of the open crib type, resting on piles. The concrete in the pier bases fills in around and over the tops of the piles, being retained during its placing by timber cribs which are left permanently in place. The concrete pier shafts extend from a point well below low-water mark to above high-water mark.

About 23,000 cu.yd. of concrete, 1,800,000 ft. of timber and 222,000 lin.ft. of piling were used in the construction of the piers.

In the bridge over the Columbia River channel there are 6875 tons of structural steel, 310 tons of steel rails and 180 tons of machinery, cables, etc. In the bridges over the Oregon and Columbia Sloughs there are 1600 tons of structural steel and 130 tons of steel rails.

The deck of the steel bridges is fireproof throughout, no timber of any sort being used as part of the permanent construction. The sidewalk is a concrete slab spanning from the curb of the roadway to a channel stringer near its outer edge. The roadway is paved with bitulithic pavement supported on a concrete slab, with concrete headers along the six lines of rails.

The bridge was opened to traffic on Feb. 14, 1917. Its total cost, including all approaches, will be 1¾ million dollars. The contractors for the main parts of the work were: For foundations, Pacific Bridge Co.; for steel, United States Steel Products Co. and Northwest Steel Co.; for erection of steel, Porter Brothers; for embankments, Tacoma Dredging Co. and Standard American Dredging Co.; pavements, Warren Construction Co.

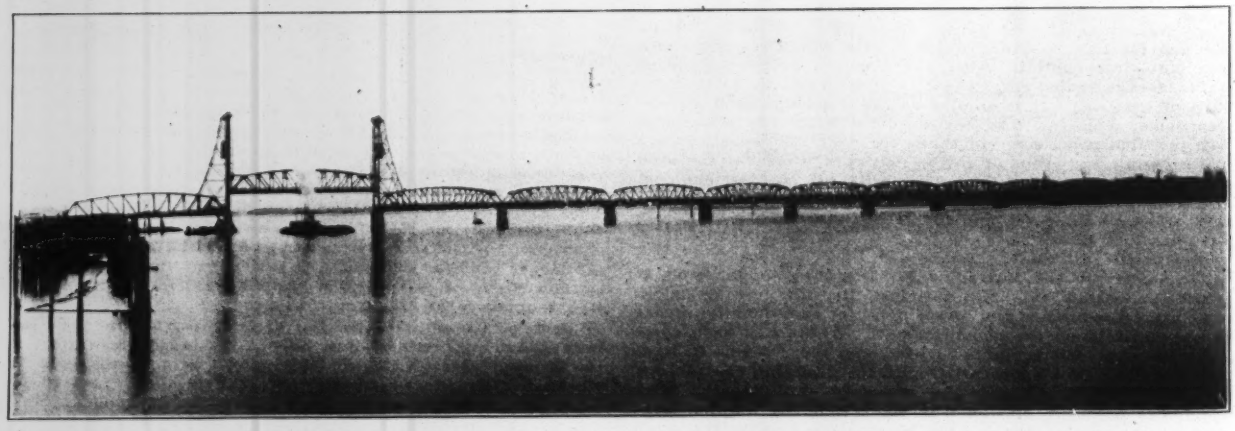


FIG. 2. ONE SECTION OF LONG STEEL BRIDGE ACROSS COLUMBIA RIVER AT PORTLAND, ORE.

Railway Engineers Meet at Chicago

The disposal of a large amount of work dealing with a variety of subjects relating to railway construction, fixed equipment and maintenance marked the 18th annual convention of the American Railway Engineering Association, held in Chicago, Mar. 20-22. Probably the two most important matters presented were the new "quick-bend test" for rails and a new impact formula for bridges, but neither was discussed, though the latter was adopted. The most active discussions were on the subjects of concrete piles, wood versus concrete trestles, and specifications for lumber.

The address of the President, A. S. Baldwin (Chief Engineer, Illinois Central R.R.) touched not only upon the technical side of railway work but upon the relation of the railways to the present national conditions and military requirements. The Association has now 1370 members, and shows an increase of 33% in five years. The officers for 1917 are as follows: President, John G. Sullivan, Chief Engineer, Canadian Pacific Ry. (Western Lines); Vice presidents, C. A. Morse, Chief Engineer, Chicago, Rock Island & Pacific Ry., and Earl Stimson, Engineer of Maintenance of Way, Baltimore & Ohio R.R.; Treasurer, George H. Bremner, District Engineer (Valuation Division), Interstate Commerce Commission; Secretary, E. H. Fritch, Chicago.

New Impact Formula

A new impact formula submitted by the Committee on Iron and Steel Structures was adopted without discussion. It does not cover provision for secondary stresses or increase of loading. The formula is as follows, L being the length of track loaded.

$$I = \frac{30{,}000}{30{,}000 + L^2}$$

Tests of impact stresses on bridges of the Norfolk & Western R.R. were reported by Professor Turneaure, of this committee. These are of special interest in comparing the effect of electric locomotives with that of ordinary and Mallet-duplex steam locomotives. They are the first tests made with electric locomotives. As cranks are used in these locomotives on this road improper balancing is a factor. It appears also that when the two sets of counterweights in a Mallet engine act in opposite directions the impact effect is even less than with electric locomotives.

Concrete and creosoted-pile trestles were compared by the Committee on Wooden Bridges and Trestles, the former being considered to have several advantages. In the discussion, however, it appeared that the report applied only to structures of 20 to 25 ft. in height, while several speakers described the satisfactory use of creosoted-pile trestles up to 60 ft. in height, using ballasted decks. Creosoted-pile trestles, properly protected against fire, may have a much longer life than is sometimes estimated. The committee finds that galvanized bolts and fastenings are not necessary in creosoted timber, and that such timber does not cause corrosion of steel upon which it rests.

Specifications for yellow-pine for preservative treatment, as submitted by the Committee on Grading of Lumber, required all timbers to be "dense pine." This was strongly opposed on the ground that while other classes of pine may have less strength that is no good reason for excluding them. In particular, Mr. Frink (Seaboard Air Line) referred to long and satisfactory experience with creosoted ballast-deck trestles of loblolly pine. The specifications were referred back to the committee.

Specifications for concrete piles (pre-cast and cast-in-place) were submitted by the Committee on Masonry. For driving the former, steam hammers are preferred, but where a drop hammer is used a heavy hammer with short drop is advocated. Professor Jacoby suggested that more should be said as to the relative advantages of the two kinds of piles, and also as to the desirability of exploring the site before deciding upon the kind of piles to be used. The specifications were referred back to the committee. Specifications for different methods of surface finish for concrete were presented also, and were adopted.

As to the design of retaining walls, the committee believes that further investigation of earth pressures should be made, and that results of real value can be obtained only by actual tests on an extensive scale.

The committee's specifications for portland and natural cement were adopted.

Rail Quality and Stresses

The proposed "quick-bend" or hydraulic-press test for rails was treated at some length in the report of the Committee on Rail, but was not discussed, the matter being submitted only as information. The report stated also that while the rail manufacturers have made some objection to the A. R. E. A. rail-sections they have submitted no data in support of their views. They have urged also that rails are now being made as well as they can be made commercially, but a report on rail failures by Mr. Wickhorst intimates that it is practicable to reduce the number and kind of rail failures to a point where the probability of accident from a broken rail is almost negligible. This view was supported in a report by Mr. Cushing (Pennsylvania Lines) which stated that while railways have introduced rails of increased weight, strength and stiffness, these changes have not been accompanied by a corresponding improvement in the quality of the material. In this connection he advocated casting ingots with the large end up.

Field tests of stresses in rails in track under rapidly moving loads are being made by the Committee on Stresses in Track, which is also conducting tests to determine the distribution of pressure downward and laterally through ballast to the roadbed. Progress was reported by Professor Talbot (University of Illinois), who also suggested that instead of considering the rail as a series of bridges spanning from tie to tie, the span should be considered rather as the distance between driving wheels.

Signals, Yards and Clearances

An analysis of the effect of passing-track locations with manual and automatic signals on the capacity of single-track roads was a feature of the report of the Committee on Signaling and Interlocking. The analysis was made with the aid of diagrams and formulas, and is of somewhat the same character as the analysis of train capacity of passenger terminals, which was worked out some time ago by the Committee on Yards and Terminals.

The latter committee presented a set of profiles for the "humps" of gravity classification yards in cold, mild and warm climates, where the traffic consists of merchandise and empties. These were adopted. The report pointed out, however, that they are suggestive only, as the actual hump profile for any yard must depend upon local conditions of climate, traffic and classification requirements. The committee submitted a number of types of ladders for the track connections of small and large yards. Two subjects of interest in regard to freight terminals were the economics of double-deck freight houses and the use of small motor trucks to haul trains of freighthouse or warehouse trucks.

Clearance limits and diagrams were the subject of considerable discussion at the 1916 meeting. This year the Committee on Electricity submitted clearance diagrams for third-rail and overhead structures, which were accepted as information. The Committee on Rules and Organization submitted a general clearance diagram, to apply to new construction only. This (as modified from the 1916 diagram) has a minimum width of 15 ft. for 12 ft. above a point 4½ ft. above base of rail. It tapers to a horizontal width of 8 ft. at 22½ ft. and 10 ft. at 8½ in. above rail base. Mr. Himes (N. Y., C. & St. L. Ry.) objected to cutting off the lower corners, and urged that the horizontal clearance of 15 ft. should extend down to rail level. After some discussion, however, the diagram as recommended by the committee was adopted.

The Committee on Economics of Railway Location suggested the elimination of formulas previously adopted for determining the comparative values of different locations, but as there was opposition to this, even in the committee, the matter was referred back for further consideration.

Roadway and Track

Plant and methods of work in making cuts and fills were dealt with in the report of the Committee on Roadway, giving the opinions of both engineers and contractors. That there is a growing feeling in favor of a more substantial foundation for the track is indicated by the fact that the committee reported on the rolling of subgrade, as practiced experimentally on two or three roads, while the Committee on Ballast advocated a considerable increase in quantity, including a bed of sub-ballast to prevent roadbed material from working up into the ballast proper. It advocates not less than 12 in. of ballast between the ties and sub-ballast.

As to washed gravel, experiments indicate that instead of requiring 25 to 35% of sand, it is improved by reducing this to about 7%. There was some discussion as to the relative merits of stone and gravel ballast, for while the former is generally considered the better, some grades of gravel are preferred to stone. The committee's proposed standard ballast sections were referred back to it for further consideration. A testing track for maintenance-of-way work was suggested, this to consist of a loop on which various kinds of track material could be tested by running over it for any desired length of time an electric car having the required axle loads, this car being controlled from a cabin.

That tie-plates have insufficient area and thickness for the increasing wheel loads was a conclusion presented by the Committee on Ties. Indications point to the use of much heavier tie-plates. It was stated also that cut spikes driven without boring holes not only hasten decay but also impair the strength of ties by the injury to the fibers. Screw spikes are less destructive. Tie-plates and spikes were considered also by the Committee on Track, whose designs for both cut and screw spikes were adopted. Experiments are being made as to the effect of brine from cars in corroding tie-plates coated with paint and tar as compared with those left unprotected.

As of interest in regard to tie preservation, the committee on Wood Preservation submitted notes on ties treated with a 10-lb. application of water-gas tar-oil, and now in good condition after four to six years' service.

Elimination of Grade Crossings

The elimination of grade crossings was dealt with in two reports. The Committee on Signs, Fences and Crossings considered the legal aspects and the apportionment of cost, while the Committee on Roadway considered the relative merits of track elevation and depression. The former committee gave favorable reports on steel and concrete fence posts. It advocated the elimination of lettering on track signs, so that these can be painted by section men. This recommendation was rejected, however, as it was shown that there is a tendency to put all kinds of miscellaneous work on the section men, while their real duty is to look after the track.

The introduction of electric traction (whether by third-rail or overhead conductor) increases the cost of maintenance-of-way according to the Committee on Electricity. This is due partly to the obstruction (in case of the third rail) and partly to the fear and caution of the men in their work. This committee also submitted the lengthy preliminary report of the American Committee on Electrolysis.

Kansas City Railway-Station Approaches To Be Improved

Two plans for improving and enlarging the approaches to the new union station at Kansas City, Mo., were submitted to vote of the people at the same time they voted down the proposed new charter, Mar. 6. The so-called larger plan carried by a vote of two to one. This calls for the condemnation of all the privately owned land between the railway tracks and 24th St. and between Main St. and Grand Ave., east of the station, and widens 24th St. west of the station to 80 ft. The smaller plan provided for widening 23d St. and 24th St. to give adequate traffic approaches.

The larger plan, which will now be carried into effect, is estimated to cost close to $2,000,000, practically double the estimated cost of the smaller plan. Bonds for $750,000 were voted for this project in 1915, but a dispute arose as to the extent of the improvement, and the alternative plans were therefore submitted for a decision. The excess cost over the amount of bonds will be assessed over a special benefit district.

Facing the station on the south is already an 8½-acre park and a plaza 400 ft. wide, so that, with the proposed parked approaches to the east and west, there are many who believe that the congestion and unsightly conditions that surround so many terminal stations have been definitely eliminated. There are no valuable buildings on any of the land to be condemned.

News of the Engineering World

One Hundred and One Officers Added to Army Engineer Reserve Corps

A list of majors and captains who had accepted commissions in the Engineer Officers Reserve Corps of the Army, up to Feb. 15, was printed in *Engineering News*, Mar. 1, p. 369. Since then the total number of officers has risen from 71 to 172. Following is a list of added majors and captains and the complete list of first lieutenants:

MAJORS ADDED

S. H. Hedges, M. Am. Soc. C. E., President, Puget Sound Bridge and Dredging Co., Seattle.
Ruckard Hurd, M. Am. Inst. M. E., Director of Mines, Minnesota Tax Commission, St. Paul.
Paul Doty, M. Am. Inst. E. E., General Manager, St. Paul Gas Light Co., St. Paul, Minn.
W. L. Webb, M. Am. Soc. C. E., Consulting Engineer, Philadelphia.
J. B. Jenkins, Valuation Department, Baltimore & Ohio R.R., Baltimore, Md.
W. J. Wilgus, M. Am. Soc. C. E., Consulting Engineer, New York City.
W. H. Herron, United States Geological Survey, Washington, D. C.
R. B. Marshall, M. Am. Soc. C. E., Chief Geographer, United States Geological Survey, Washington, D. C.
A. C. Harper, United States Engineer Office, Albany, N. Y.
F. J. Wood, M. Am. Soc. C. E., Stone & Webster, Boston, Mass.
G. E. Verrill, M. Am. Soc. C. E., United States Assistant Engineer, New London, Conn.
F. W. LaForge, M. Am. Soc. C. E., Fort Wright, New London, Conn.
W. B. Harrison, M. Am. Soc. C. E., United States Assistant Engineer, Washington, D. C.
A. M. Walker, United States Geological Survey, Washington, D. C.
J. H. Jennings, United States Geological Survey, Washington, D. C.
G. T. Hawkins, United States Geological Survey, Washington, D. C.
F. I. Wheeler, United States Engineer Office, Cleveland, Ohio.

CAPTAINS ADDED

J. S. Doyle, M. Am. Soc. C. E., Baltimore.
E. A. Gibbs, Assoc. M. Am. Soc. C. E., Manager of Erection, McClintic-Marshall Co, Pittsburgh.
A. H. Pratt, M. Am. Soc. C. E., Assistant Engineer, Board of Estimate, New York City.
E. B. Murray, Assoc. M. Am. Soc. C. E., Consulting Engineer, Kansas City
W. O. Washington, Assoc. M. Am. Soc. C. E., Contracting Engineer, San Antonio, Tex.
A. Stellhorn, Assoc. M. Am. Soc. C. E., Civil Engineer, U. S. Q. M. Corps, Gatun, C. Z.
J. S. Herbert, M. Am. Soc. M. E., Johnstown, Penn.
W. D. Peaslee, M. Am. Inst. E. E., Consulting Engineer, Portland, Ore.
J. W. Skelly, M. Am. Soc. C. E., United States Assistant Engineer, St. Louis.
H. W. Hudson, M. Am. Soc. C. E., Engineer of Construction, New York Connecting Ry., New York City.
J. D. Irving, M. Am. Inst. M. E., Sheffield Scientific School, New Haven, Conn.
A. B. Searle, United States Geological Survey, Washington, D. C.
E. H. Ropes, Assoc. M. Am. Soc. C. E., Civil Engineer, United States Coast Guard, Washington, D. C.
E. B. Butchers, Assoc. M. Am. Soc. C. E., American Bridge Co., Ambridge, Penn.
F. W. Green, St. Louis, Mo.
W. L. Miller, United States Geological Survey, Washington, D. C.
H. J. Stehli, M. Am. Inst. M. E., Mining Engineer, New York City.
J. F. Barber, Philadelphia.
C. B. Stanton, Carnegie Institute, Pittsburgh.
R. B. H. Begg, Assoc. M. Am. Soc. C. E., Virginia Polytechnic Institute, Blacksburg.
C. T. Osborne, St. Louis, Mo.
H. V. Pittman, United States Engineer Office, St. Louis, Mo.
C. C. Elmer, Ridley Park, Penn.
M. W. Smith, American Steel Foundries, Chicago.
P. J. Wilson, M. Am. Inst. E. E., Lowell Electric Light Corporation, Lowell, Mass.
F. E. Foster, St. Louis, Mo.
G. T. Street, M. Am. Inst. E. E., Youngstown, Ohio.

COMPLETE LIST OF FIRST LIEUTENANTS

C. W. Wilder, New York City.
J. M. Marshall, Brooklyn, N. Y.
Walter M. Meir, Bartlesville, Okla.
William Burton, Montclair, N. J.
H. B. Barling, Glendon, N. C.
S. H. Sherrerd, East Orange, N. J.
D. W. Krellwitz, New York City.
F. C. Allen, 3rd, Milwaukee, Wis.
William Hague, Grass Valley, Calif.
A. C. Forbes, Brooklyn, N. Y.
M. R. Scharff, Pittsburgh, Penn.
C. L. Harrod, Altoona, Penn.
L. C. Waterbury, Oriskany, N. Y.
K. J. Zinck, Portland, Ore.
Edward B. Snell, New York City.
H. H. George, Newark, N. J.
John Leo Desch, Maplewood, N. J.
M. T. Coakley, Buffalo, N. Y.
R. J. O'Brien, New York City.
Harry T. Griswold, Lyme, Conn.
G. A. Schneider, Hammond, Ind.
J. Schlessinger, Baltimore, Md.
E. K. Carley, East Orange, N. J.
E. P. Gray, Toledo, Ohio.
Walter H. Dunlap, Washington, D. C.
A. F. Edel, New York City.
Hugo C. Soest, New York City.
James F. C. Hyde, Detroit, Mich.
J. R. Wemlinger, New York City.
Henry Taylor, Philadelphia, Penn.
L. C. Josephs, Jr., Schenectady, N. Y.
E. L. Bandy, Washington, D. C.
Robert Boettger, Yonkers, N.Y.
Warren Gardner, New York City.
T. C. Thogerson, St. Louis, Mo.
H. L. Haverstick, Philadelphia, Penn.
L. S. Leopold, Pottstown, Penn.
S. Steenerson, Crookston, Minn.
John R. Eakin, Washington, D. C.
Luria L. Lee, Washington, D. C.
R. B. Carver, New York City.
E. L. Hain, Washington, D. C.
Harry V. Newcomb, Cape Girardeau, Mo.
Frank W. Hamilton, Groton, Conn.
John E. Terhune, Albany, N. Y.
Evan W. Scott, E. Roanoke, Va.
James F. Ryder, Watertown, Mass.
A. S. Mirick, Plattsburg, N. Y.
E. D. Hendricks, Fort Plain, N. Y.
T. H. Moncure, Washington, D. C.
Seth W. Webb, Cleveland, Ohio.
Samuel H. Brooks, Wakefield, Mass.
Frank T. Leilich, Swissvale, Penn.
Gordon H. Fernald, Somerville, Mass.
B. D. Barker, Chicago, Ill.
F. Miller, Lynn, Mass.
Theodore Belzner, New York City.
A. E. Crane, Plainfield, N. J.
F. N. Wildish, Chicago, Ill.
R. W. Queal, Kansas City, Mo.
John G. Kelly, Jr., Portland, Ore.
Robert W. McLean, Bridgewater, Mass.
Louis N. Sperry, Utica, N. Y.
A. D. Stoddard, Kansas City, Mo.
J. R. Armington, Ambridge, Penn.
Alexander A. Laird, Dallas, Tex.

Pittsburgh Bridges Ordered Raised

The fourteen-year fight of the river interests against the users and owners of the bridges over the Allegheny River at Pittsburgh ended with victory when Secretary of War Baker, on Mar. 23, handed down an order that the bridges should be raised, and as the power bestowed on the Secretary of War by the Act of Congress of March, 1899, to order removed any bridges which he shall find

to be "unreasonable obstructions to navigation" has been tested and sustained previously before the Supreme Court, there seems to be little hope for the opponents of bridge-raising. The river men, reinforced by the recommendations of every U. S. Engineer officer stationed in succession at Pittsburgh, have reopened their case with each succeeding Secretary of War. The owners have urged in vain that the case once decided in their favor by Secretary of War Root should be allowed to rest, but at the rehearings before Secretaries Dickinson and Taft were successful in persuading them that no new facts had arisen to alter the conditions on which Secretary Root based his decision. Mr. Baker feels otherwise, and after studying the facts brought out in a hearing in Pittsburgh in January-February of 1916 and subsequent reports of the U. S. Engineers has decided:

> The bridges in question are unreasonable obstruction to the navigation of the Allegheny River.
>
> Their immediate elevation and the relocation of their piers is necessary in the national interest.
>
> These improvements ought to be undertaken in such an order as to make the inconvenience to the people of Pittsburgh during their progress the least possible.

Six of the bridges affected are owned by Allegheny County, but 75% to 80% of the burden of reconstruction would fall on the taxpayers of the city of Pittsburgh. The actual cost of the rebuilding is estimated at $3,600,000, and it was testified by the city's representatives at the hearings that the damages incident to changes of the approaches of the bridges would be $4,651,000. Up to a few years ago most of the bridges were owned by toll companies; the county acquired them at a cost of $2,530,000.

The Sixth, Seventh and Ninth St. bridges would be raised 7 to 9 ft. the Thirtieth St. bridge 3 ft. The Sixteenth and Forty-Third St. bridges, wooden Howe-truss structures with stiffening arches, are required to be rebuilt 12 and 15 ft. higher. The requirements for pier location and channel span of not less than 350 ft. will make the re-use of any of the present bridges impossible.

The other bridge affected by the order is the double-deck four-track structure of the Pennsylvania Lines West of Pittsburgh. At the time of its construction the railroad was required to agree to raise the spans at such time as the raising of the other bridges was ordered. The Pittsburgh Junction bridge of the Baltimore and Ohio R.R. at Thirtieth St. has already been planned to be rebuilt at a higher elevation, to connect with the track elevation over Liberty St., Pittsburgh.

Flood Control and Land Reclamation Helped by Court Decision

On Mar. 14 the Supreme Court of California rendered a decision which is of great importance as affecting flood control in the Sacramento and San Joaquin Valleys. In this decision the Supreme Court reversed the decision of the Superior Court of Sutter County (Sam Gray, et al. vs. Reclamation District No. 1500) which had granted an injunction restraining that district (the Sutter Basin project) from constructing certain levees which would raise the flood plane in the vicinity of the plaintiff's land and at times cause it to be overflowed.

The effect of this decision in California, aside from permitting District No. 1500 to continue the construction of its levees, is to uphold the powers of the State Reclamation Board and the plan of flood control for the Sacramento Valley as outlined in the report of the California Debris Commission of 1910 (House Document No. 81, 62nd Congress, 1st Session), which plan was adopted by the State of California and the Reclamation Board formed to carry it into execution.

The decision may also be of interest to others who have to do with flood control, as in the Ohio and Mississippi Valleys, as it very clearly and definitely gives the principles upon which the decision is based, particularly those relative to the police powers of the state, and the relation of surface waters to flood waters in time of flood.—From R. L. Jones, Sacramento, Calif.

Kansas To Have Highway Commission

A State Highway Commission has been created in Kansas by an act approved on Feb. 28. The commission is to be made up of the governor, ex officio, as chairman, and two members to be appointed by him. The appointed members are to receive as compensation $5 per day for time actually spent, but not to exceed a total of $200 per year, plus their necessary traveling expenses. The commission is to appoint a secretary and chief engineer and fix their salaries. The commission is to have general supervision over the construction and maintenance of all roads, bridges and culverts, except township roads, and shall furnish information to town commissioners, county engineers and other highway officials.

Each board of county commissioners is required to appoint a competent county engineer, who is to prepare plans, specifications and estimates for roads, bridges and culverts built by the county. Two or more counties may unite, however, and employ a county engineer jointly. The salaries of county engineers are fixed according to the population of the county, ranging from $1300 per annum in counties with 10,000 to 15,000 population to $2000 per annum in counties having more than 30,000.

River Straightening at Cleveland is again actively under discussion. The present motive is the difficulty of locating piers for the proposed Lorain-Huron bridge across the valley of the Cuyahoga River without resorting to excessive span lengths; the river now makes a sharp bend in the vicinity of the proposed bridge crossing, and the bridge as laid out by law runs along one bank for a distance and then crosses on a sharp skew. The $5,000,000 authorized by popular vote for the construction of the bridge is considered to be practically unavailable until the bend of the river has been replaced by a straight cut.

Los Angeles Continues To Grow in Area by the annexation of territory. On Feb. 26, Owensmouth was annexed by popular vote. It had an area of less than a square mile and brings the total area of the city up to 338.69 sq.mi. Owensmouth was already surrounded by Los Angeles as a result of a recent annexation. It has just been brought into the City of Los Angeles in order to get the benefit of aqueduct water. On Apr. 6, an election will be held for the annexation of more "shoe-string" territory, comprising a narrow strip of ocean front at and near Hyperion, the terminus of the Los Angeles sewer-outfall system, and also a strip of land running from Hyperion back to Los Angeles.

The Electrification of the main line of the Pennsylvania R.R. across the Allegheny Mountains, between Altoona and Conemaugh, has been planned for some time by the Pennsylvania R.R. officials. President Rea in his recent annual report stated that the only work done during the year on the project was the continuation of detail surveys, the designing and construction of the type of electric locomotives required, and obtaining the experience of other railways in the use of electric traction for heavy freight and passenger trains. He intimated that the carrying out of the improvement would be postponed until the present period of high cost of construction material and scarcity of labor had passed.

Indiana Has a State Highway Commission, created on Mar. 6, composed of four members appointed by the Governor. The salary is $600 a year each. The Commission is to select the state highway engineer and to fix his salary, but in no case shall the overhead expense exceed $50,000 a year. The state money for the Highway Commission's work is to include $100,000 from the general state fund this year and $500,000 in 1918, to which will be added the inheritance tax collected annually by the state, approximating $400,000. In addition to this money the United States Government will add an equal amount up to and including the year 1920.

PERSONALS

J. R. Ellis has been appointed Assistant Engineer, State Highway Department of Missouri.

J. P. Davis has been appointed Assistant Engineer, State Highway Department of Missouri.

W. A. Freret has opened offices as a contracting engineer in Windsor, Colo. He will specialize in drainage and tile work.

David A. Decker, for the past six years Assistant City Engineer of Norfolk, Va., has resigned to become associated with Gilbert C. White, consulting engineer, Durham, N. C.

L. D. Len, former City Engineer of Lead, S. D., has resigned to become Chief Engineer in charge of the Engineering Department of the Export Service Corporation, Chicago.

Oscar F. Dalstrom has been appointed Engineer of Bridges of the Chicago & Northwestern Railway Co. Mr. Dalstrom was graduated from Rensselaer in 1901 and has been with the railway several years.

G. N. Toops, Assoc. M. Am. Soc. C. E., formerly Assistant Engineer with the Missouri, Oklahoma & Gulf Railway Co., has been appointed Engineer of Maintenance-of-Way, with offices at Muskogee, Okla.

C. S. Bilyeu, Assoc. M. Am. Soc. C. E., formerly with Hildreth & Co., engineers, New York City, has become associated with the Gulick-Henderson organization of inspecting engineers, New York City.

Harry J. Childs has resigned as Chief Engineer of Power and Lines of the United Traction Co. of Albany, N. Y., to become head of the electrical department of the Chateaugay Ore and Iron Co., Lyon Mountain, N. Y.

Herbert A. Meyer, for four years Private Secretary to Franklin K. Lane, Secretary of the Interior, has been appointed Assistant Secretary of the Interior. He will have administrative charge of the Alaskan Ry. Mr. Meyer is 30 years old and a native of Ohio.

Ernest S. Alderman, Jun. Am. Soc. C. E., formerly United States Junior Highway Engineer, Department of Agriculture, Washington, D. C., has been appointed Supervising Engineer on the expenditure of a $500,000 bond issue passed by Beauregard Parish, De Ridder, La.

Howard F. Weiss, whose resignation as Director of the Forest Products Laboratory of the United States Forest Service takes effect Apr. 1, has become associated with the C. F. Burgess Laboratories, Madison, Wis. Mr. Weiss will direct the division relating to wood products.

Hugh L. Conway, for the past three years Principal Assistant Engineer in charge of the Street and Sewer Division, Cincinnati, has resigned to become General Manager of the Citizens' Road Preserving Co. Mr. Conway was graduated from the Ohio State University in 1896.

E. D. Kilburn, Assoc. Am. Inst. E. E., formerly Manager of the Power Department of the New York office of the Westinghouse Electric and Manufacturing Co., has been appointed District Manager, to succeeed W. S. Rugg, whose change of service is noted elsewhere in this column.

W. S. Rugg, M. Am. Inst. E. E., formerly District Manager of the New York office of the Westinghouse Electric and Manufacturing Co., succeeds Charles S. Cook as Manager of the Railway Department, with headquarters in East Pittsburgh. Mr. Rugg was born in Broadhead, Wis., and is a graduate of Cornell.

A. W. Graham, formerly Chief Executive Officer of the Park Department of Kansas City, Mo., has been appointed State Highway Engineer of Missouri. After graduation from the Missouri University in 1908, Mr. Graham went with Waddell & Harrington, and later was Assistant County Engineer of Jackson County.

H. S. Slocum has joined the Engineering Department of the Aluminum Company of America and will be resident engineer in charge of construction at Potsdam, N. Y. Mr. Slocum was resident engineer for the Cedars Rapids Power and Manufacturing Co. during the construction of the large Cedars development near Montreal. He was then in charge of construction for the Northern New York Power Corporation, and more recently represented the Shawinigan Water and Power Co. as resident engineer during the completion of the Grand' Mere development of the Laurenticle Power Co., after the Shawinigan company acquired an interest in the Laurentide concern. In earlier years he had been associated with Viele, Blackwell & Buck on the Great Western and Appalachian hydro-electric projects.

OBITUARY

James E. Gardner, City Engineer of Napa, Calif., died recently in Oakland.

John C. Wills, a mechanical engineer, died in Detroit on Mar. 16, at the age of 81 years.

R. J. Maloney, engineer in the Bureau of Sewers, New York City, died in Brooklyn, N. Y., on Mar. 19.

Robert J. Gillespie, Vice President of the T. A. Gillespie Co., New York City, died in Millvale, Penn., on Mar. 20, at the age of 47 years.

William H. Rogers, a consulting engineer, died at his home in Philadelphia recently, at the age of 78 years. He was formerly Superintendent of the Cramps' shipyard.

John Bacon Wood, a retired dock builder, died at his home in Brooklyn, N. Y., on Mar. 20, at the age of 90. His largest contract is said to have been the docks, basin and bridge of the Gowanus Canal, Brooklyn.

John Kasson Howe, Director and Eastern sales representative of the Osgood Co., Marion, Ohio, died at his home in Albany, N. Y., on Mar. 4, from angina pectoris. He organized the Osgood Dredge Co. in 1883, which company obtained the original patents on the boom-type dredge. He served as Secretary and Treasurer of that concern until its consolidation with the Osgood Co.

Daniel Wheeler Bowman, M. Am. Soc. C. E., consulting engineer for the Phœnix Iron Co., died on Mar. 13. He was born in New Bedford, Mass., in 1844, and was graduated in civil engineering from Cornell University. His first work was with Capt. James B. Eads at the mouth of the Mississippi River, directly under Elmer L. Corthel, late president of the American Society of Civil Engineers. In 1876 he became connected with Clarke-Reeves & Co., now the Phœnix Bridge Co., resigning in 1885 to go to Florida on the inspection of bridges for the Southern Railway Co. For a short time he was connected with the Boston Bridge Works, but in 1894 returned to Phœnixville in the engineering office of the Phœnix Iron Co., under H. H. Quimby, then chief engineer. About 1896 he resigned from the Phœnix Iron Co. and entered into the structural fabricating business in Chicago, returning to the Phœnix Iron Co. in 1898, and becoming Chief Engineer two years later. In 1914 he resigned and was made Consulting Engineer, in which office he continued until the time of his death.

ENGINEERING SOCIETIES

ST. LOUIS RAILWAY CLUB.
Apr. 13. Secy., B. W. Frauenthal, Union Station, St. Louis.

DETROIT ENGINEERING SOCIETY.
Apr. 21. Secy., D. V. Williamson, 46 Grand River Ave., W., Detroit.

SOUTHWESTERN ELECTRICAL AND GAS ASSOCIATION.
Apr. 26-28. In Dallas. Secy., H. S. Cooper, 405 Slaughter Building, Dallas, Tex.

The Astoria (Ore.) Society of Engineers was organized recently in that city with 12 members. The new organization will be affiliated with the Oregon Society of Engineers. The officers are: President, A. C. Rose; secretary, W. A. Hanston.

The National Association of Manufacturers will hold a meeting on Thursday, Mar. 29, at 2 p.m., at the Waldorf-Astoria. The subject of the meeting will be "Chile as a Field for Manufacturers and Investors," by the Hon. José A. Del Campo F., official delegate of the Chilean Government.

The American Society of Mechanical Engineers will hold its spring meeting in Cincinnati, May 21 to 24. A feature will be a joint session on May 22 with the National Machine Tool Builders' Association, at which papers will be presented on employees' service work and industrial education as developed in Cincinnati

Appliances and Materials

Support Inserts for Concrete Work

An adjustable insert, providing support or fastening for machinery or fixtures in concrete, has recently been marketed by the Medina Machine Co., of Medina, Ohio. It has the form of a truncated pyramidal box with ears on the face for nailing to forms and holding in place during pouring. The device is

MEDINA INSERTS FOR FASTENING MACHINERY TO CONCRETE WORK

shown assembled and broken in the accompanying view. For final use a special nut is slipped in edgewise and tipped over. Nuts are easily removed. A solid insert of similar shape is also made by the same concern.

* * *

Patented Asphalt-Sand Pavement, "Bitosan"

Patents have been issued, and others are pending, covering a method of constructing a sand-asphalt pavement, which it is claimed has been used with success in Falmouth, Mass. The new type of pavement is known by the trade name of "Bitosan," and the patents are controlled by the United States Asphalt Refining Co., 90 West St., New York City.

The Bitosan pavement consists of two (or sometimes three) courses. The foundation course, or base, is a hot mixture of Bitosan asphaltic cement and mineral aggregate of sand or gravel. The second, or wearing course, is a properly graded sand aggregate and a special asphaltic mastic or filler consisting of "Bitosan surface asphalt" and a finely pulverized material incorporated with it.

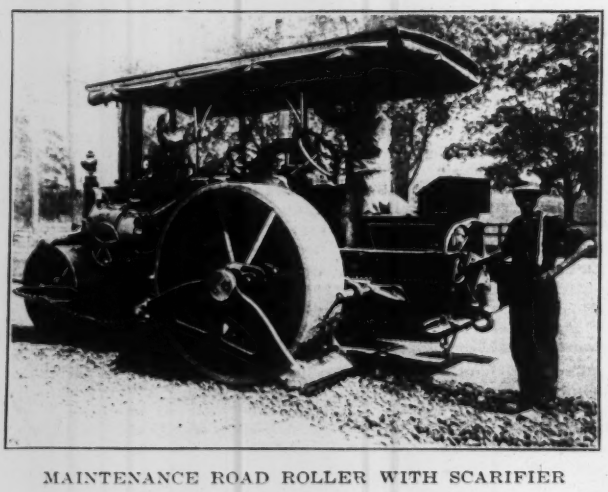
After the foundation course is laid, it is immediately compressed with a tandem roller and then protected from dust and sand by a covering. After the base is roughened, the wearing surface is immediately added and rolled. The sand to be used in construction must be analyzed and passed upon by a laboratory maintained by the patentees.

* * *

Maintenance Road Roller with Scarifier

A type of small three-wheel steam roller, known as a maintenance roller, has been introduced into this country from England, where it has been in successful use for a number of years. The distinctive feature of this maintenance roller is the scarifier attachment on one of the rear driving wheels. This is in the form of a yoke, as shown in the accompanying illustration, which can be tipped to make the teeth, or prongs, dig into the roadway, while traveling in either direction.

It is claimed that this attachment will loosen and break up water-bound macadam that has been treated with heavy oil



MAINTENANCE ROAD ROLLER WITH SCARIFIER

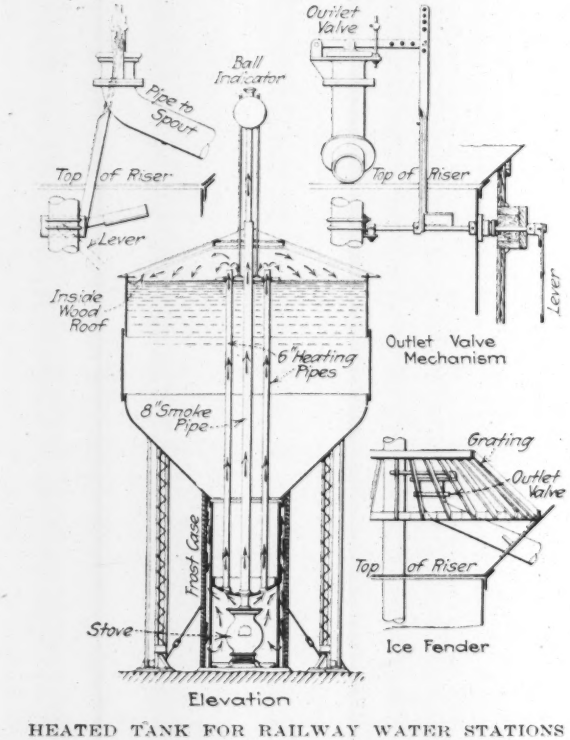
and has a thick crust. It has been used for this purpose by several New England cities, and two of these rollers are now owned by the Massachusetts State Highway Commission. One of them was exhibited at the recent Good Roads Show in Mechanics Hall, Boston. The rollers are made by the Buffalo Springfield Roller Co., Springfield, Ohio.

* * *

Heated Water Tanks for Railways in Cold Climates

The heated tank for railway water stations, shown in the accompanying drawing, is being designed for districts where very low temperatures are experienced and where water from ice-cold rivers is delivered to the tank. It is known as the "Canadian special" type and is built by the Chicago Bridge and Iron Works, of Chicago.

To prevent accumulation of ice inside the tank, a heating chamber is provided under the 6-ft. riser pipe, by raising the riser about 7 ft., giving ample room for a stove. The smoke and gases are carried off by an 8-in. wrought-iron pipe extending through the tank and roof. A 5-in. air space is formed



HEATED TANK FOR RAILWAY WATER STATIONS

by a frost casing built of two layers of dressed and matched lumber, with building paper between them. In this space circulates hot air from the chamber, and in this way the entire height of the riser is warmed. Heated air from the chamber is delivered also into the top of the tank by means of 6-in. wrought-iron pipe extending above the water line, thus preventing the formation of surface ice. A wood roof inside the steel roof assists in retaining the heat in the space above the water. No trouble from corrosion of the wrought-iron smoke pipe has been found. To avoid the ice troubles experienced with valves operated by overhead levers, the valve is operated from below by mechanism which is contained within the riser. The heating pipes are placed as closely as possible to the outlet valve and its operating mechanism. A fender or conical grating is placed above the top of the riser, so that even if the water is allowed to get low in the tank, ice cannot clog or damage the valve mechanism. The valve cap is cast solid, and the annular recess for the rubber seat is machined, thus getting a tighter fit than when the recess is cored in the casting.

* * *

India Ink Solvent

A fluid for cleaning drawing ink from tracing cloth, with the trade name "Rasindia," is being made by Anderson & Furman, 110 West 40th St., New York City. It is claimed that it leaves no trace of the ink and does not affect the tracing cloth. It is rubbed on with a saturated cloth.

ENGINEERING NEWS

CHARLES WHITING BAKER, *Editor*

Published Weekly by McGRAW-HILL PUBLISHING CO., Inc.
Tenth Avenue at Thirty-Sixth Street, New York, N. Y.
Chicago, Monadnock Bldg. Cable Address: "ENGNEWS, N.Y."

JAMES H. McGRAW, President
E. J. MEHREN, Vice President and General Manager
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Subscriptions payable in advance, $5 a year, including postage in the United States, Mexico, Cuba, Porto Rico, Hawaii or the Philippines; $7 in Canada.

To foreign countries, including postage, $9 or its equivalent. Subscriptions for Great Britain, Europe or British Colonies may be sent to London Office, 6 Bouverie St., London, E. C., England. Notice to change address should be written to the New York Office in every instance.

Entered at New York Postoffice as mail matter of the second class.

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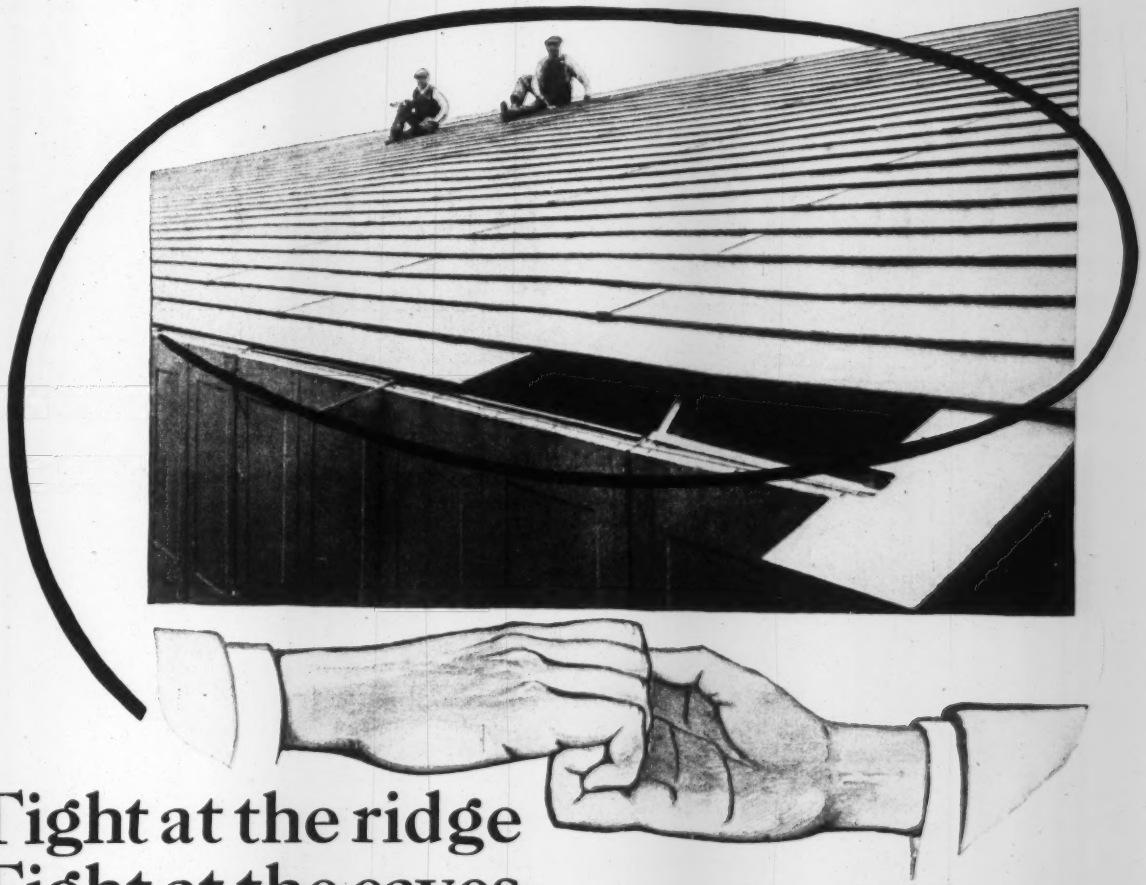

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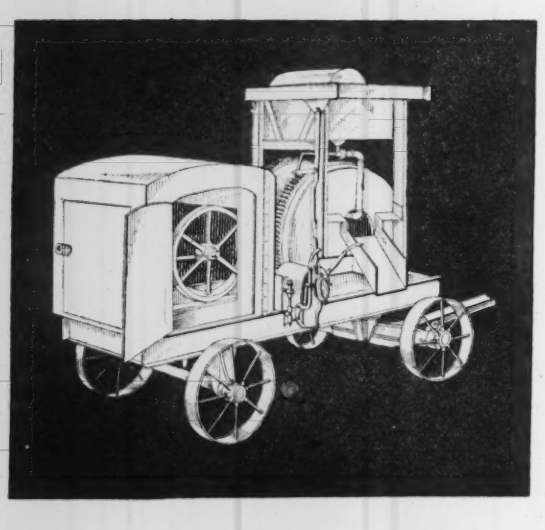

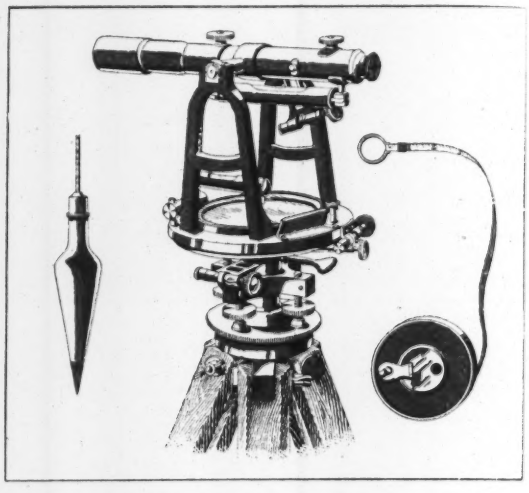

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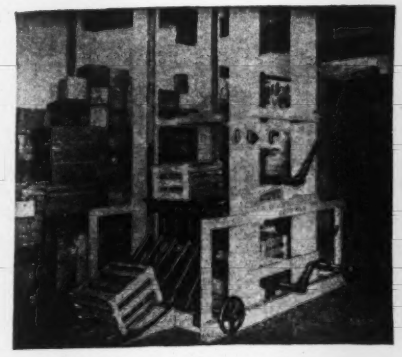

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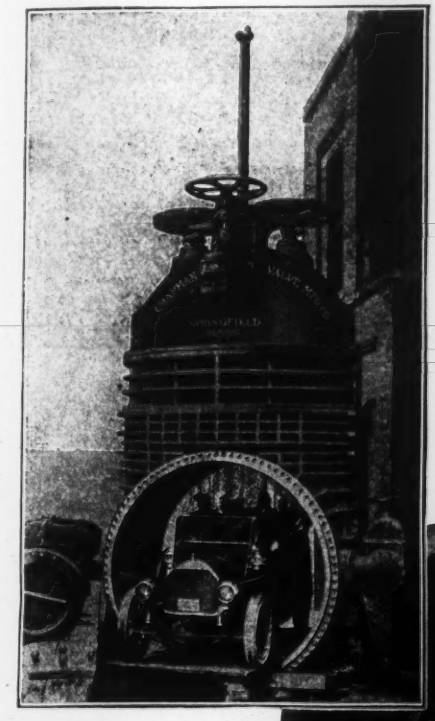

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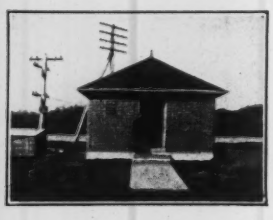
Look for the Venturi Meter advertisement on this page in every alternate issue

Venturi Discovers an Eel in the Pump



Considerable power loss, possible injury to the pump and contamination of the water supply at North Cromwell, Conn., was prevented by observing the reading of the 12-inch Venturi Meter at the Cromwell Water Company plant.

The meter tube is installed in the discharge line of a motor driven 700 gallon three-stage De Laval Centrifugal Pump. It is connected with our old style Type D Register-Recorder.

One evening in August 1914, the operator discovered that the meter recorded a flow of only 500 gallons, yet the ammeter showed approximately normal current.

After shutting down that night the pump casing was opened and a large eel and piece of wood were found lodged in the impeller. These were removed and the pump placed back into service again. It immediately resumed its full rating.

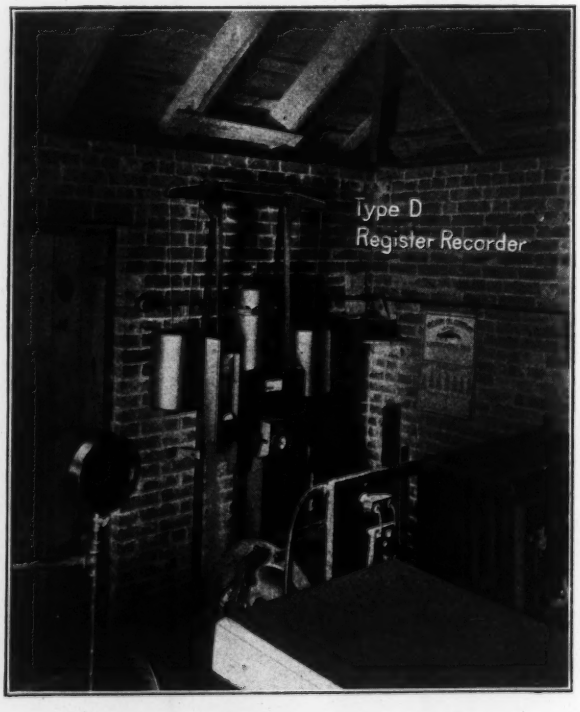
The Venturi Meter was also used in checking the capacity and efficiency of the pumps during the acceptance tests.

"My pump has made good, as shown by the meter," was one way in which the operator stated his supreme confidence in the Venturi.

Venturi Meters are invaluable for guiding the economical operation of both centrifugal and reciprocating pumps.

With our Type M Register-Indicator-Recorder they show the rate of flow at the moment of observation, register the total flow; and trace a continuous chart record of all variations in the rate of flow during every minute of the day or night.

— Bulletin No. 84-N gives interesting details. Address Department T.



Venturi Meter Type "D" Register-Recorder installed in Pump House at North Cromwell, Conn.

Builders Iron Foundry, Providence, R. I.

Now Ready

Wharves and Piers

Their Design, Construction and Equipment

By **CARLETON GREENE**, A. B., C. E., Member, American Society of Civil Engineers. *248 pages, 6x9, 155 illustrations, $3.00 net, postpaid.*

Up to this time there has been no treatise on modern American practice in the design and construction of wharves and piers. Mr. Greene has prepared this book on the basis of a broad experience and a thorough investigation of American practice. He covers not only design and construction of wharves, piers, sheds and their equipment, but gives valuable data on machinery for handling miscellaneous package freight.

All forms of construction are covered fully. In the belief that the present tendency is to overestimate the advantages of reinforced concrete, as compared with timber construction, the author has laid great emphasis on the principles and methods requisite for durability in wooden wharf construction.

Valuable Cost Data

The data this book gives on the cost of walls, piers and sheds is especially valuable. The entire appendix is devoted to this phase of the work. In some cases comparative unit costs have been given; in other cases, total contract prices.

This is the first time that the subject of the cost of wharves and piers has been fully covered.

Outline of Contents

I. Introduction. II. Primary Principles of Design. III. Details of Timber Construction. IV. Retaining Walls for Piers and Marginal Wharves. V. Piers. VI. Pier Sheds. VII. Equipment of Wharves and Piers. VIII. Cargo Handling Machinery. Appendix.

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They are as indispensable to the reinforced concrete designer as are the handbooks of the steel manufacturers to the steel designer.

In preparing this work, every effort was made to produce a thin book of convenient size—a real pocket handbook The result is an immense amount of data compressed into a minimum of space.

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N-3-29

This rope was ruined by corrosion and internal friction.

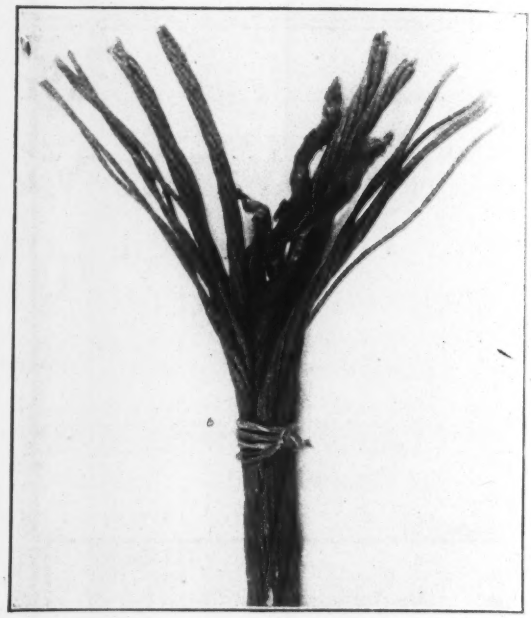
As can be seen by the photo, the core is in a decayed condition.

The wires of the inner strands are worn almost flat in places and are corroded and pitted almost to the breaking point.

The wires are brittle and could be broken between the fingers.

The rope is of a brownish color due to an accumulation of rust—rust means ruin.

This rope was NOT treated with "Crater."

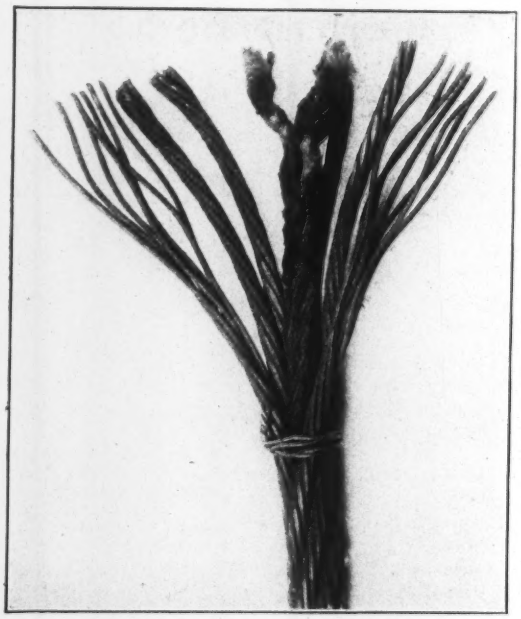


This rope has done six times the work of the other. It was still in service when the picture was taken.

The center is fresh and pliable. While the crown of the rope is slightly worn, due to extreme friction, the inner strands are in a healthy condition.

The rope shows up bright and clear. No rust. No corrosion. Its tensile strength has not been impaired materially.

This rope WAS treated with Texaco Crater Compound.



These ropes were made by the same manufacturer, of identical materials, and used right next to each other.

Their difference in life is due ENTIRELY to Texaco Crater Compound. Throughout this country Texaco Crater Compound is saving hoist ropes from destruction by wear, internal friction and corrosion whether worked dry or exposed to tainted waters. It is doing this with a great reduction in lubricating expense.

In a booklet called "About Texaco Crater Compound," we tell how and why Crater saves wire rope and other outdoor equipment. It also tells the best way of lubricating wire rope and shows a diagram of a simple and efficacious appliance for this purpose.

Write for the "Crater" book.

There is a Texaco Lubricant for Every Purpose.

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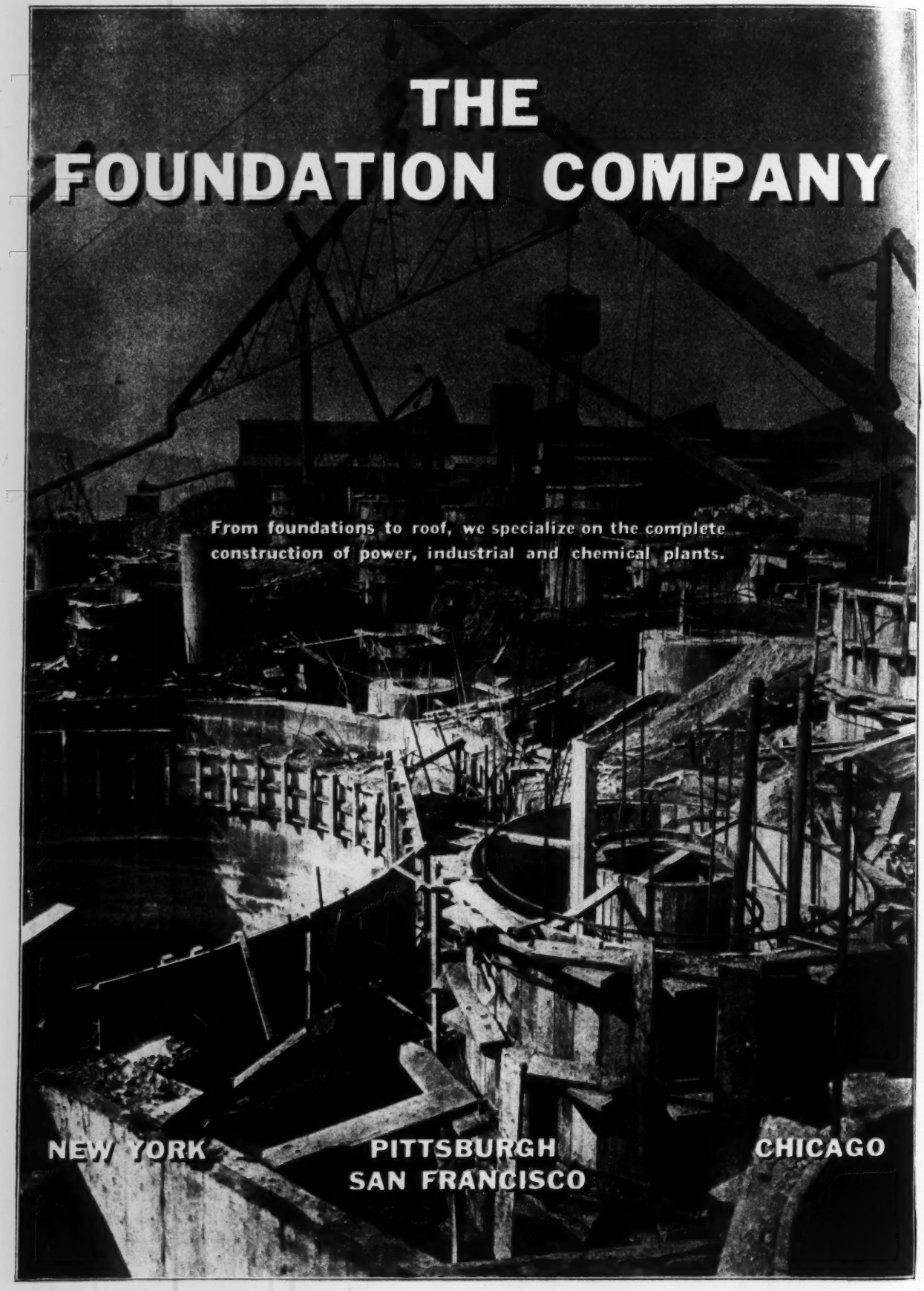
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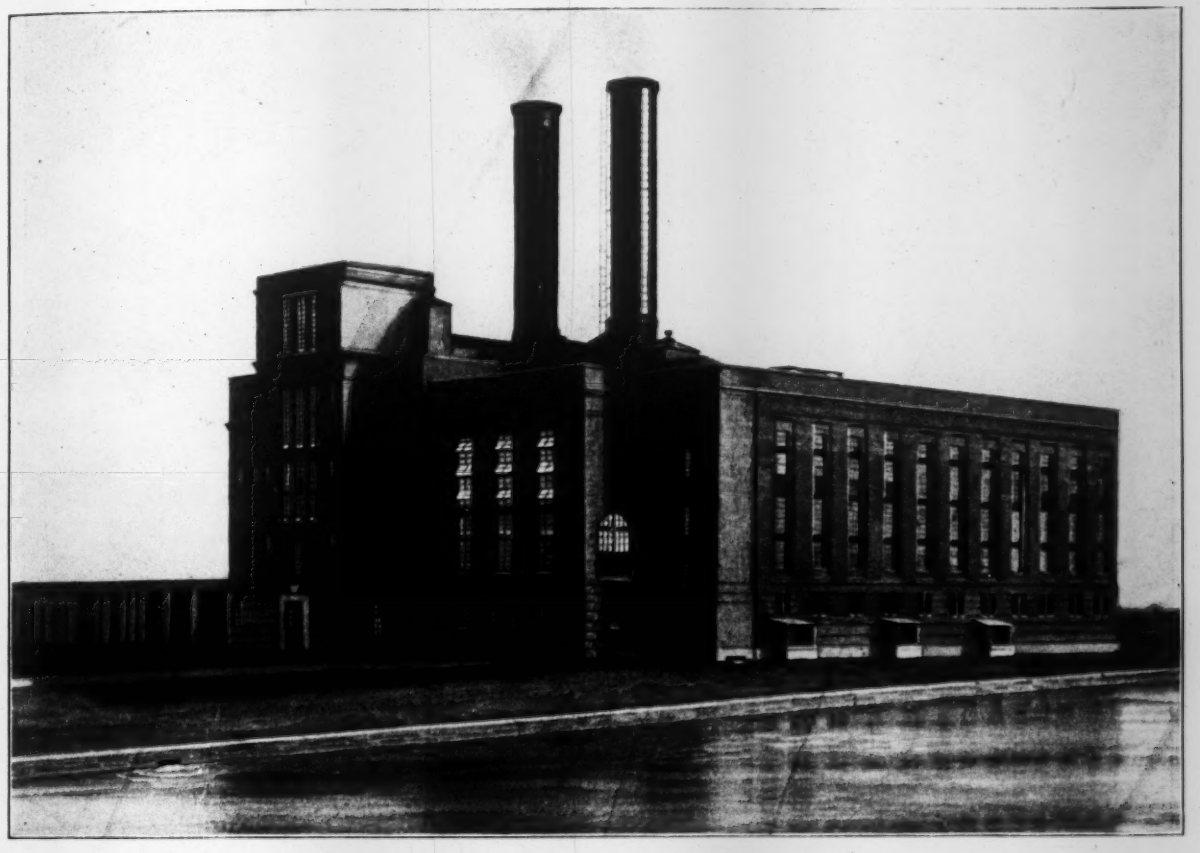
NEW NIAGARA RIVER POWER STATION

THE NIAGARA RIVER STATION

BUFFALO GENERAL ELECTRIC COMPANY



Designed and built by Stone & Webster Engineering Corporation.

Henry G. Stott, Consulting Engineer for Buffalo General Electric Co.

Initial capacity - - - - - - - - -	60,000 Kw.
Extension now in progress - - - - - - - -	35,000 Kw.
Designed for ultimate capacity of - - - - -	200,000 Kw.

In commercial operation ten months and twenty days after breaking ground.

A world's record has likely been made as regards time of construction. The ground was broken for this work in January, 1916, and the Station was put in commercial operation in November of the same year, a truly remarkable performance in normal times to say nothing of conditions such as we have just passed through with regard to the difficulties in obtaining materials, labor and other necessities for completing a large engineering job of the kind.

—POWER, February 13, 1917.

STONE & WEBSTER ENGINEERING CORPORATION

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NEW NIAGARA RIVER POWER STATION

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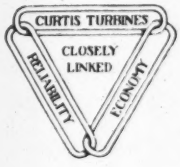
NIAGARA'S 200,000 KILOWATT STEAM ALLY



Curtis Steam Turbines

The opposite page represents the Turbine room of the Niagara River Station of the Buffalo General Electric Company as it will appear when the 35,000 kilowatt Curtis Steam Turbine Generator, now under construction, is added to the three 20,000 kilowatt Curtis Steam Turbine Generators now installed.

General Electric Company

General Office: Schenectady, N. Y. **Sales offices in all large cities**

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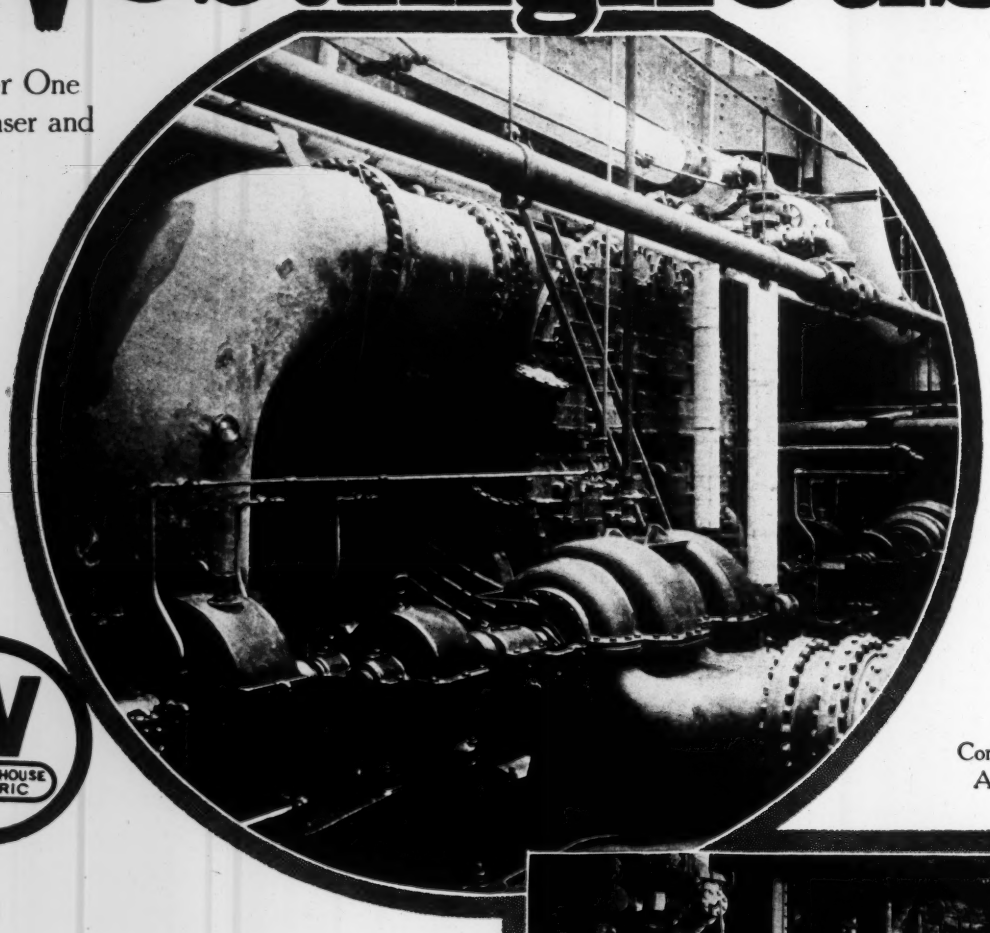
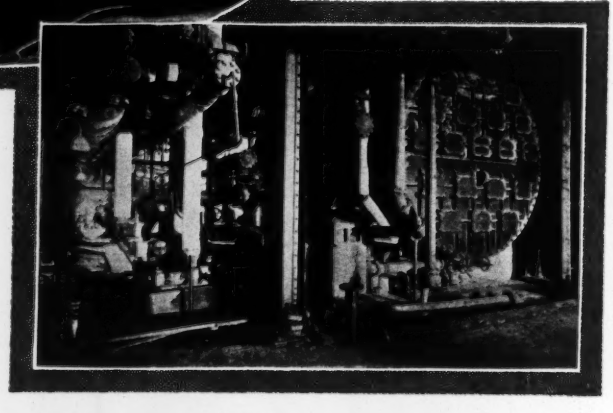
NEW NIAGARA RIVER POWER STATION

Westinghouse

Number One
Condenser and
Pumps



Condenser and
Air Pumps



The condensing equipment in this plant consists of three Westinghouse Surface Condensers with Westinghouse Leblanc Air Pumps and Westinghouse Circulating Pumps, all driven by Westinghouse Non-Condensing Turbines through their well-known Reduction Gears. This equipment, clearly shown in the accompanying views, serves all the main generating units.

Each Condenser has a capacity of 33,000 sq. ft. and is capable of condensing 220,000 pounds of steam per hour. For this purpose 40,000 gallons of cooling water per minute s needed.

The condensers have two circulating pumps each. Each pump has a capacity of 25,000 gallons, sufficient for full-load operation under minimum temperature conditions.

The boilers, which operate at 275 lbs. pressure with 275° superheat are fed by four-staged cen-

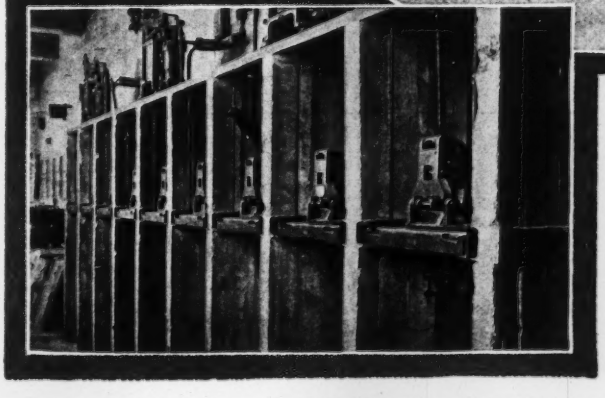
Westinghouse Electric & Mfg. Co.
East Pittsburgh, Pa.

NIAGARA'S 200,000 KILOWATT STEAM ALLY

Westinghouse

Switchroom

Oil Switches



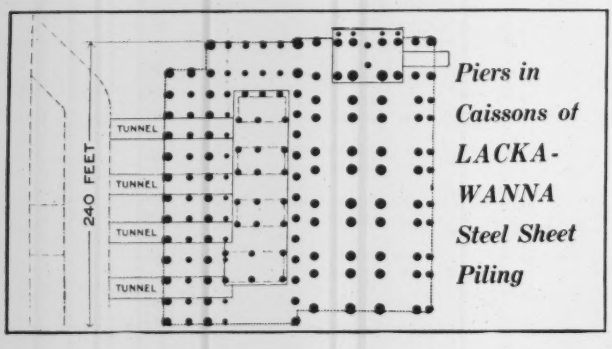
trifugal pumps driven by Westinghouse Turbines.

The actuating or nerve center of the entire Power Station—the main switchroom and operator's table—is shown at the top of this page.

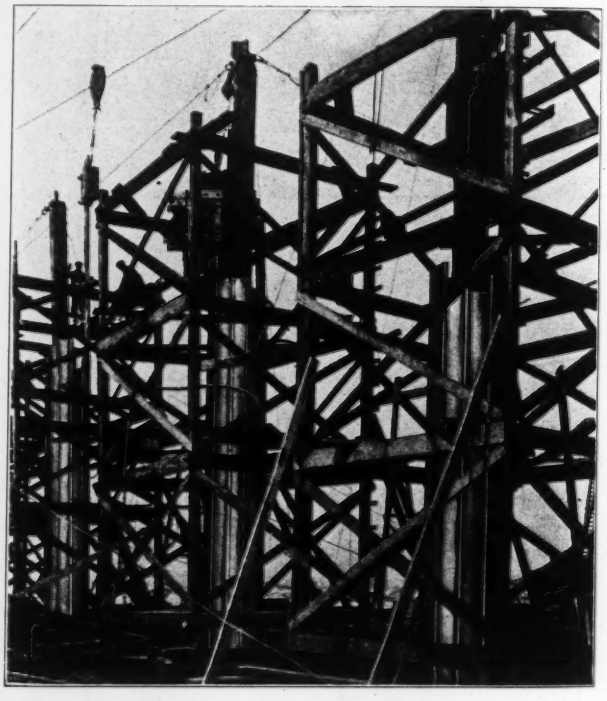
On the left of this view is the main switchboard controlling at present the three 20,000 K.W. generators. Beyond it is the auxiliary switchboard with 16 panels. On the right is the feeder board with 6 panels each having a front and rear section. 31 panels are now installed and space is provided for future additions. The innumerable indicating and recording instruments, switches, etc., in the picture were manufactured and installed by the Westinghouse Electric & Mfg. Company as well as auxiliary equipment consisting of oil switches (lower view) and a great quantity of other apparatus such as disconnecting switches, instrument transformers, lightning arresters, etc.

Westinghouse Electric & Mfg. Co.
East Pittsburgh, Pa.

Lackawanna Steel Sheet Piling Used in Build-



Piers in Caissons of LACKA-WANNA Steel Sheet Piling



A big foundation problem faced the Engineers in building the NIAGARA RIVER STATION and the manner in which it was solved with the use of Lackawanna Steel Sheet Piling will be gathered from these views of the work in progress.

The Station and machinery rest on bed rock. The rock is 40 ft. beneath the surface of a low-lying shore and 157 concrete and steel piers penetrate the intervening stratum of soil. The panorama shows one of the 16 rows of piers going in with cableways 300 ft. long handling the sheet piling.

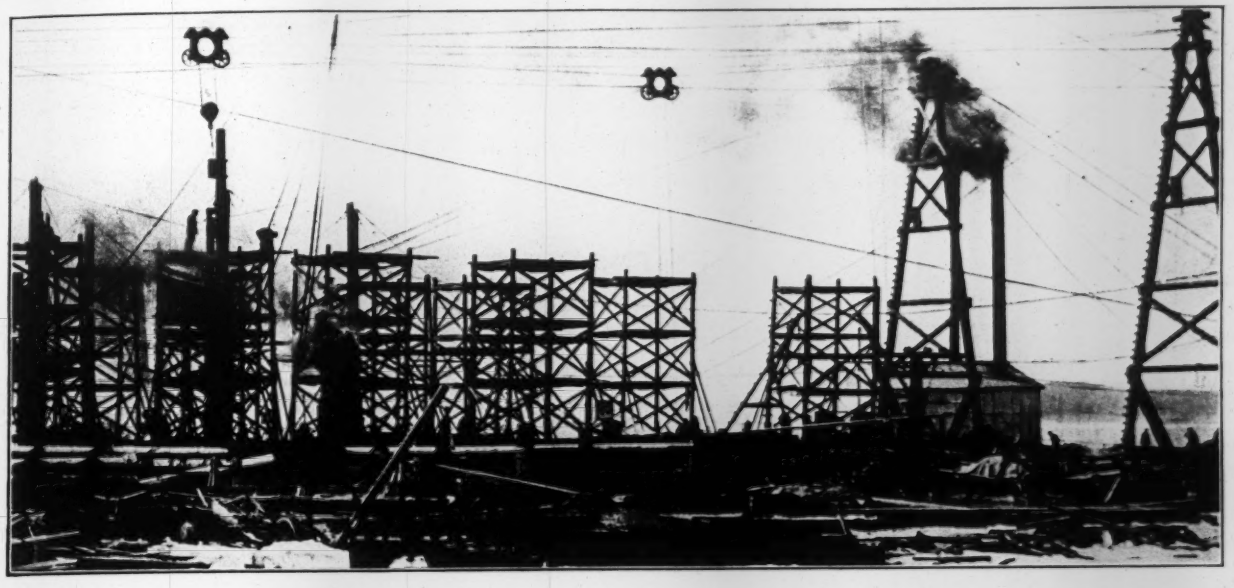
Each pier is built in a separate caisson of sheet piling which becomes a part of the permanent pier structure. Approximately 70,000 lineal feet of the 12-34 x 3/8 Section Lackawanna Steel Sheet Piling was used to form these cylinders. The driving by means of steam hammers suspended from tackle on centrally placed masts is shown in the vertical view above, while on the opposite page is the top view of a cylinder driven and above it the wooden form which shaped it, all piers being driven in the same manner.

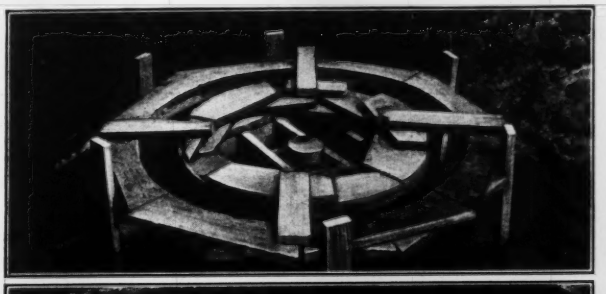
The entire work was carried out and the concrete placed under severe winter conditions in seventy working days. The average time for driving a cylinder was six hours and this included penetration into bed rock 6 to 18 inches.

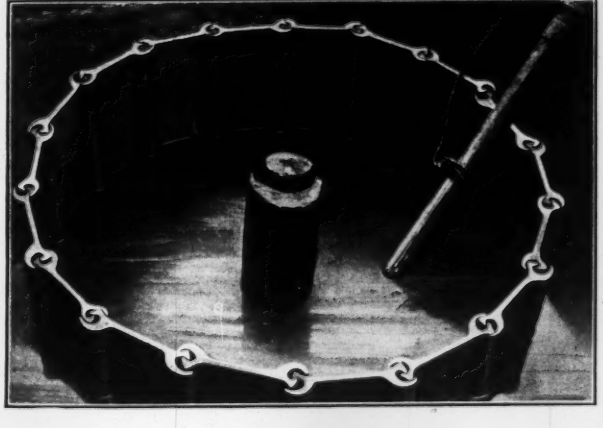
The caissons surrounding the turbine foundations

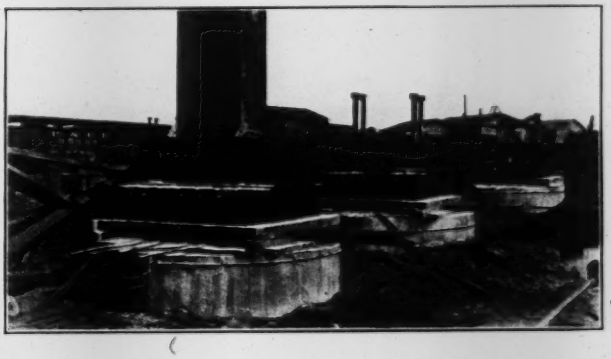
NIAGARA'S 200,000 KILOWATT STEAM ALLY

ing Foundation Piers, Canals and Tunnels









were also of Lackawanna Piling and some 344 tons of the Arched Web Type were used for the construction of condensing tunnels and intake. These waterways under maximum conditions for the 200,000 kilowatts of the finished Station will carry 2,500,000 gallons an hour or a quarter more water than will flow to New York City in the new Catskill Aqueduct.

Now that our piling can be obtained with special bent webs to produce cylinders of every practical diameter, pier foundations can be made in this way to meet every requirement of safety, strength and reasonable cost

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NEW NIAGARA RIVER POWER STATION

Hayward Orange Peel Buckets

Ask for Bucket Catalog No. 43.

In the sinking of the foundation caissons and in excavating for crusher pit, water tunnels, intakes and screen well at the Niagara River Station, Hayward Orange Peel Buckets played an important part.

157 caissons were sunk and these varied in diameter from 30 in. to 7 ft. Four Hayward Orange Peel Buckets were used ranging in capacity from 2 cu. ft. to 9 cu. ft.

For the initial excavation work in these caissons, hydraulic jets and ejectors were used operating under a water pressure of 180 lbs. per sq. in. The Hayward Buckets were then used for digging out the coarse gravel and boulders which remained in the bottom 30 ft. below water level. The total amount of material removed with the assistance of these Buckets was approximately 17,800 cu. yds.

In addition to the Orange Peel Type, we also make Clam Shell Buckets, Drag Scraper Buckets and Electric Motor Buckets. Our new Catalog 43 illustrates and describes these various Buckets and contains numerous photographs of the kinds of work for which the several types are suited.

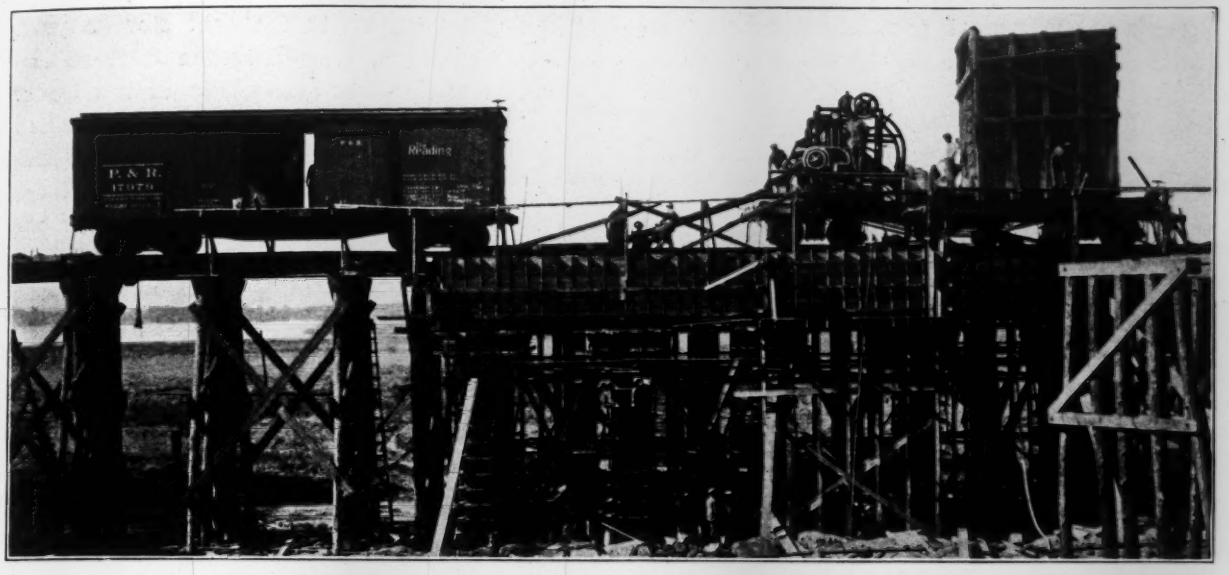
THE HAYWARD COMPANY

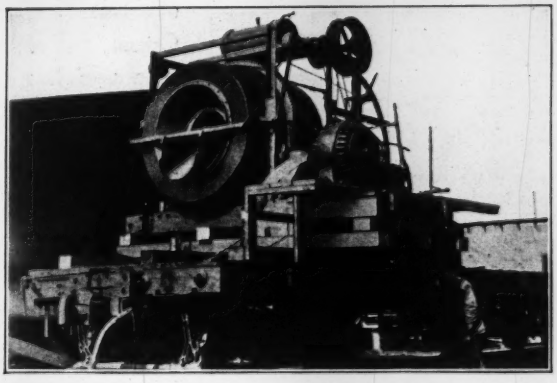
Builders of Orange Peel, Clam Shell, Drag Scraper and Electric Motor Buckets

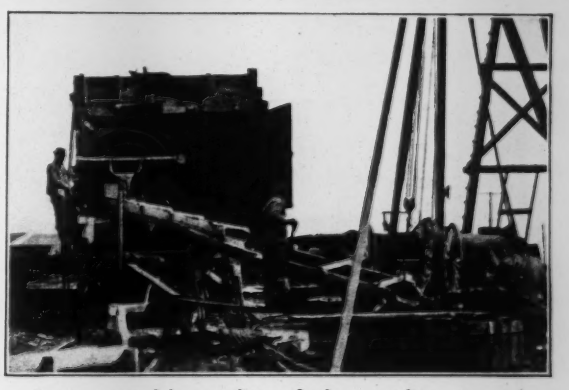
50 Church Street, New York, N. Y., U. S. A.

NIAGARA'S 200,000 KILOWATT STEAM ALLY

Smith-Chicago Mixers Mixed the Concrete for the Foundations, Tracks, Tunnels, Intakes, etc.







Concrete entered extensively into the construction of the NIAGARA RIVER STATION, 40,000 barrels of cement being used with 20,000 yards of sand and 34,000 yards of stone. The bulk went into the elaborate system of 157 foundation piers and the waterways for condensing water and was laid by Smith-Chicago Mixers.

For concreting the 157 piers, tracks were laid in the lanes between the waiting cylinders of steel sheet piling which extend 40 feet down to bed-rock. The above views show the method of mounting a Smith-Chicago Mixer to make a portable outfit and also outfits at work on a concrete trestle and on foundations.

Plying on the tracks between the steel cylinders and feeding concrete through a tremie, such an outfit worked with the utmost rapidity and insured speed where speed was a vital factor. Faith in its complete dependability under all conditions led to the selection of the Smith-Chicago for this big job and it fully met the most exacting requirements of continuous service in the severest winter weather that western New York had seen in twenty years.

Send for Smith-Chicago Catalogue No. 11-L

THE T. L. SMITH COMPANY

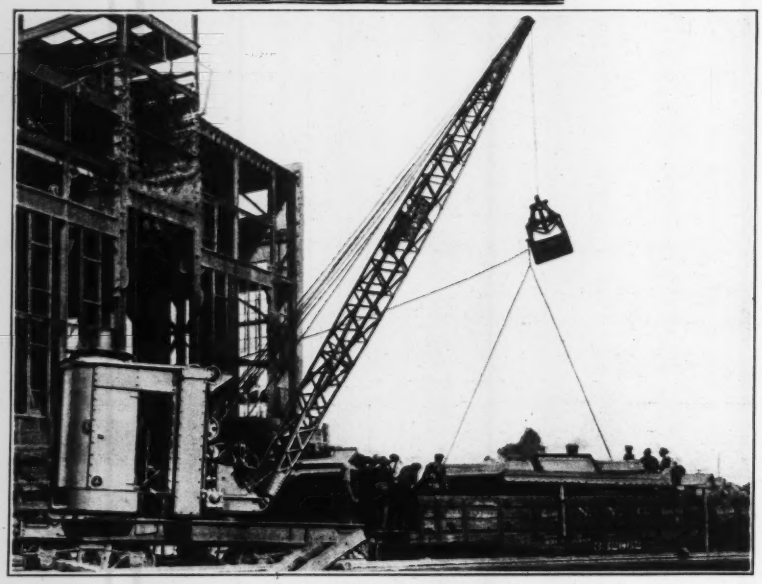
3102-L Hadley St., MILWAUKEE, WIS.

Brownhoist Crane Gives Complete Operating and Construction Service

There is no busier piece of machinery or equipment connected with the NIAGARA RIVER STATION than the Brownhoist Locomotive Crane shown on this page. It also enjoys the distinction of being the only important machine that saw the site practically at the breaking of ground, stayed with the Job throughout the construction period, and will now remain as part of the permanent equipment.

Serviceable as the Crane was in assisting with the excavation, in maneuvering portable concrete outfits, in feeding cement, stone and sand and in handling the vast amount of freight, its most important function now comes in tending the Station in actual operation. It will haul cars of coal directly into the Station over the coal crushers, or it will take them to the coal storage yard and unload them, depositing the coal at distances up to fifty feet either side of the track. During construction the Crane has been called upon to lift 12 tons with boom at short reach and from this down to 2½ tons at full reach. It operates on curves of 75 feet radius and as a locomotive hauls two 50-ton cars up 2% grades.

BROWNHOIST



Upper View, Unloading Steel
Lower View, Handling Concrete Materials

The ultimate service required of this Brownhoist Crane, and a service which must be absolutely unfailing in its regularity, will be best appreciated when it is understood that with 200,000 kilowatts installed, it will have to handle 175 tons of coal each hour. This is a place where only a quality crane, the best the market affords, will do; hence BROWNHOIST.

THE BROWN HOISTING MACHINERY COMPANY

CLEVELAND, OHIO

BRANCH OFFICES in New York, Pittsburgh, Chicago, San Francisco, and (Portland, Ore., Colby Eng'r Co.)

Engineers and Manufacturers of Heavy Dock Machinery, Bridge Cranes, etc., as well as smaller cranes and hoists

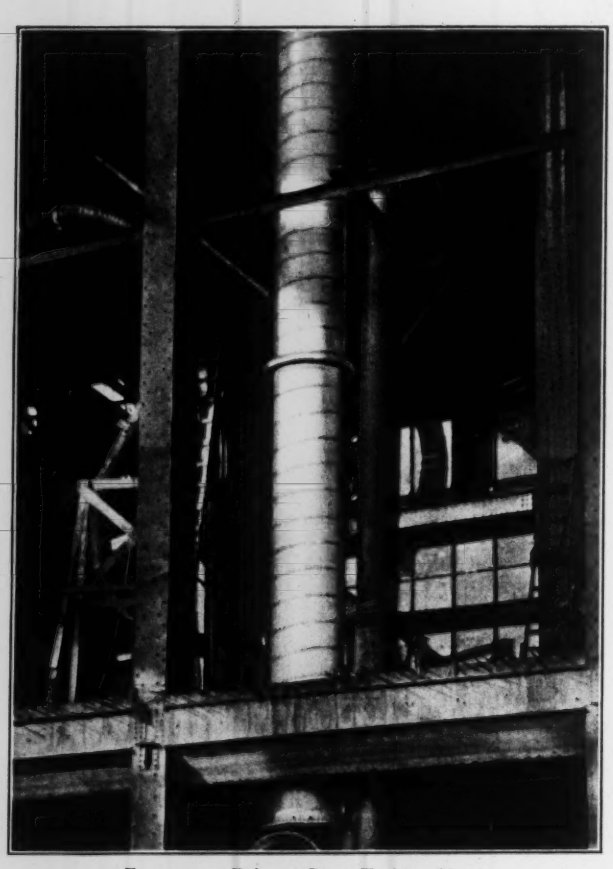
Mead-Morrison Coal Handling

The capacity of each half of the duplex system of coal handling installed by the Mead-Morrison Manufacturing Co. in the Niagara River Power Station is 200 tons an hour. There are two independent motor-operated crushers, two McCaslin bucket conveyors, elevating to the full height of the Station, and two belt conveyors running the full length. The total combined travel one way is nearly 700 feet.

MEAD-MORRISON MANUFACTURING CO.

NEW YORK EAST BOSTON, MASS. CHICAGO

American Spiral Riveted Pipe Emergency Exhaust



Emergency Exhaust Pipe, Turbine No. 1

Spiral Riveted Pipe

Spiral Riveted Atmospheric Exhaust Pipe, one for each turbine.

73 feet in height, 36 inches in diameter extending from basement to roof of the station.

The pipe is of American Spiral Pipe Works manufacture, galvanized after completion, with FORGED STEEL Flanges attached.

It has enormous bursting strength, exceptional resistance powers against collapsing under vacuum; great strength and rigidity against bending.

Galvanizing insures thorough protection.

Extensively used for Exhaust Steam and Condenser Water Circulating Systems.

Sizes 3 to 42 inches in diameter.

Lap Welded Pipe

MANUFACTURED

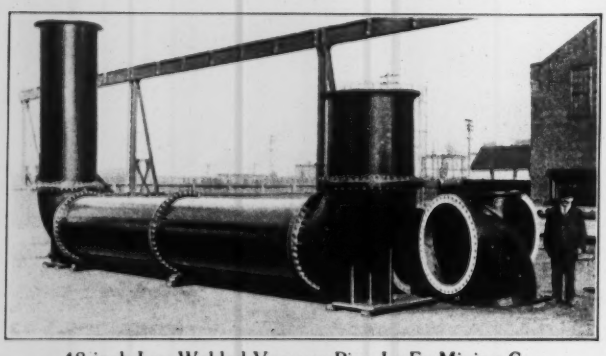
Sizes: 12 to 72 inches.

Thicknesses: $\frac{1}{8}$ to $1\frac{1}{2}$ inches.

FOR:

High Pressure Steam Mains Condenser Pipe.
Gas Mains.
Water Supply.
FORGED STEEL Pipe Flanges for High Pressure Steam Pipe.

Two Scenes at the Plant of the American Spiral Pipe Works, Chicago



48 inch Lap Welded Vacuum Pipe La-Fe Mining Co.

Forged Steel Pipe Flanges

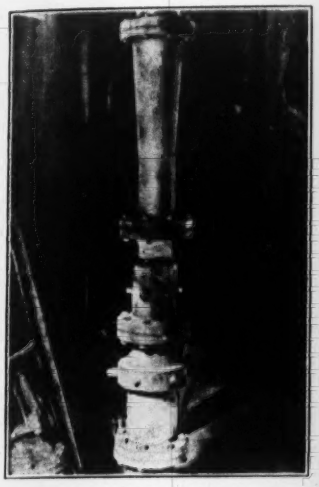
Catalogues and full information upon request

AMERICAN SPIRAL PIPE WORKS

Main Office and Works, CHICAGO, ILL., P. O. Box 485 New York Office, 50 Church Street

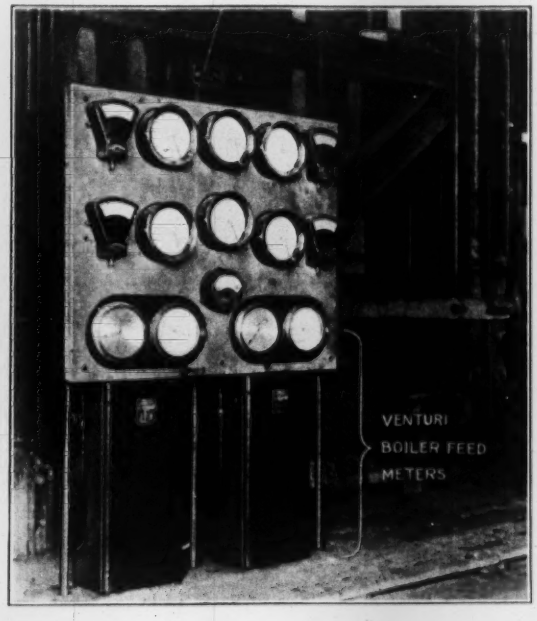
NIAGARA'S 200,000 KILOWATT STEAM ALLY

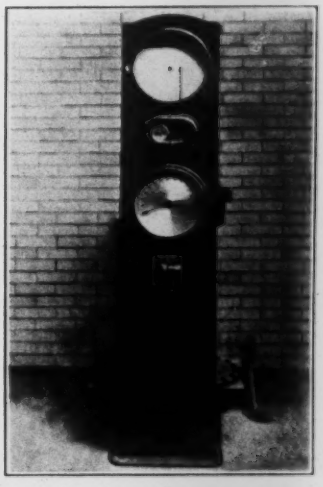
First and Last "Venturis" Measure the Flow



Above is one of the 6-inch Venturi Tubes through which the water passes from Turbine Number One.

The center picture is the gauge board for Number One Boiler.





Each boiler has such a gauge board.

Above at the right is the Venturi Instrument for Number One Turbine near the unit on the turbine floor.

For the water entering each boiler and the condensate coming from each turbine there is a complete Venturi outfit manufactured by the Builders Iron Foundry to measure and record the quantity. With the installation of 95,000 kw. there will be evaporated normally 1,400,000 pounds of water per hour and the turbines will return 1,000,000 pounds; a total of 2,400,000 pounds in all passing through the Venturis.

A unique feature of the STATION is the adoption of boiler gauge boards. These boards, one for each boiler, are mounted on the standards, made by the Builders Iron Foundry, which carry the dials of the Venturi recording apparatus. Thus the Venturi Instruments and the other boiler gauges form one structure, which is immediately under the eye of the operator.

One dial of the Venturi shows the rate of entering water, and the other records the continuous 24-hour consumption of the boiler in the usual manner. The Tubes are located between the boilers and the economizers. While the boiler evaporates normally 137,000 pounds an hour, the Venturi attached has a capacity of 170,000 pounds.

The Venturis on the turbines are between the hot-well pumps and the feed-water heaters. Each 20,000 kw. turbine requires 212,000 pounds of water an hour, but each Venturi has a capacity of 275,000 pounds. The Venturi instrument boards for the turbines are on the floor of the turbine room beside the machines.

This complete application of Venturi Meters at all points in this most modern power station employing the highest steam temperatures and pressures yet used on a large plant for the attainment of final economy, speaks for itself. But Venturi service goes beyond the mere installation of the Meter. We are ready to recommend improvements in boiler feeding methods whenever opportunity presents. Test out Venturi Service by writing today, stating your problem.

BUILDERS VENTURI IRON FOUNDRY

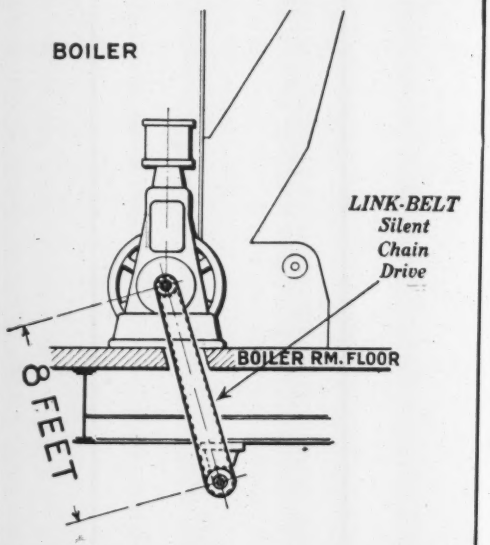
BUILDERS IRON FOUNDRY PROVIDENCE, R. I.

"Builders of the Venturi"

New York Pittsburgh Chicago San Francisco Los Angeles Seattle Portland

NEW NIAGARA RIVER POWER STATION

Link-Belt Silent Chains Drive the Stokers



LINK-BELT Silent Chain Drive connecting engine with drive shaft on one of the boilers

Link-Belt Silent Chains connect the Stoker engines with the Stoker drive shafts on each of the five boilers. The five chains all run on 8 ft. centers and transmit normally 20 h.p. each. They speed up the Stokers as the peak load comes on the Station and the demand on each boiler gradually increases to six thousand horse power.

Link-Belt Silent Chain has been chosen for a severe duty in connection with one of the most important features in the NIAGARA RIVER STATION, but years of service under all conditions have proved it the most reliable and satisfactory for power transmission. The Link Belt Chain is flexible as a belt, positive as a gear, more efficient than either. It transmits power quietly, without slip or loss, eliminates journal friction and is immune against deterioration due to heat, cold, moisture or oil.

In factories the best production records,—quality of output, uniformity of production, uninterrupted operation—are being made today by machines driven through Link-Belt Silent Chains. Reliability —Stability—Efficiency (over 98%) depend on the exclusive feature of Link-Belt Silent Chains—a patented Pin-Bushed-Joint-Construction—a round pin and two case hardened semi-circular bushings—found in no other chain. Fully explained in 112 page price list Data Book No. 125—sent on request.

Look for the name on the washers
Look for the liners in the joints

LINK-BELT COMPANY

PHILADELPHIA		CHICAGO		INDIANAPOLIS	
New York	299 Broadway	Detroit	732 Dime Bank Bldg.	Los Angeles	161 N. Los Angeles St.
Boston	49 Federal St.	Wilkes-Barre	2d Nat'l Bank Bldg.	Denver	Lindrooth, Shubart & Co., Boston Bldg.
Pittsburgh	1501 Park Building	Minneapolis	418 S. Third St.	San Francisco	461 Market Street
St. Louis	Central National Bank Bldg.	Louisville	F. Wehle, Starks Bldg.	New Orleans	Whitney Supply Co., 418 S. Peters St.
Buffalo	698 Ellicott Square	Seattle	580 First Ave. South	Knoxville	Empire Bldg.
Cleveland	1304 Rockefeller Bldg.	Portland, Ore	14th and Lovejoy Sts.	Birmingham	D. T. Blakey, 309 Am. Trust Bldg.
Charlotte, N. C.	J. S. Cothran, Com'l Bank Bldg.	Toronto	Canadian Link-Belt Co., Ltd.		

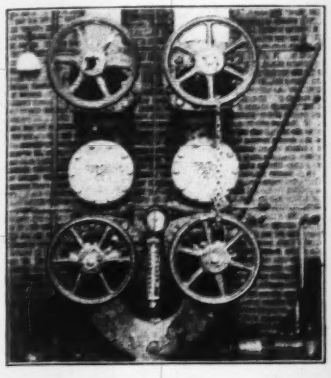
NIAGARA'S 200,000 KILOWATT STEAM ALLY

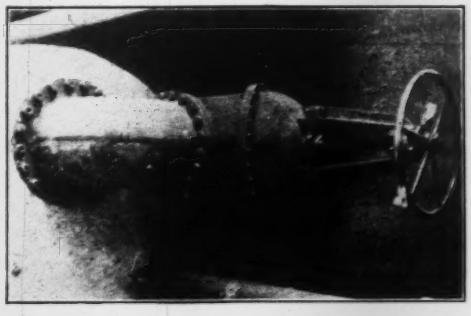
Pratt & Cady Valves in the Niagara River Power Station

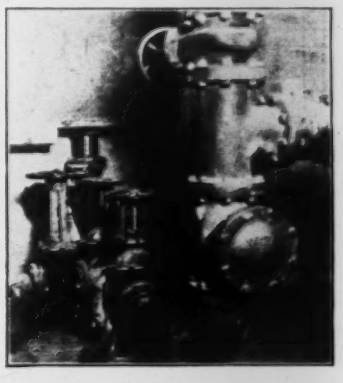
A group is shown of four typical installations of the many Pratt & Cady Valves variously situated on the large and medium-sized steam and water mains throughout the Niagara River Station.

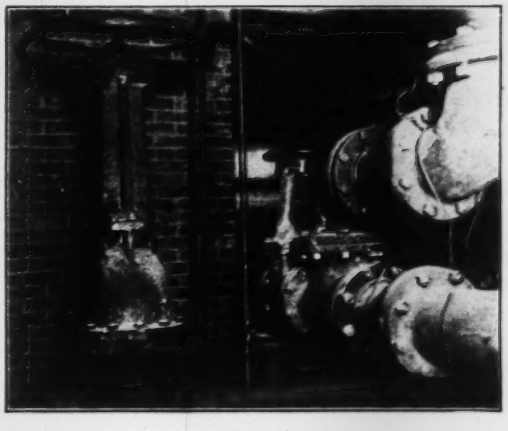
The upper and lower pictures of the group, it so happens, exemplify the wide range of location of our valves in the job. The photograph above was taken similarly equipped, and the 4-inch check valves in the boiler feed piping next the boiler stop valve, twenty in number, are Pratt & Cady make. This comprises all the steel check valves on the high pressure steam piping of the Station.

In the right hand photograph five of our valves are shown in a single group in connection with









near the top of the Station on the boiler side and shows the 20-inch valve on Feed Water Heater No. 3. The other three feed water heaters, similarly equipped with Pratt & Cady Valves, are illustrated in one group elsewhere in this Campaign.

The lower photograph, taken in the basement of the Station, shows one of the 20-inch valves on the main auxiliary exhaust opposite the Number Three turbine, and back of it are two other "P & C" valves, the smaller on the air exhaust and the larger on force draft fan No. 3.

The left photograph shows two of the 6-inch check valves on the discharge from one of the boiler feed pumps. Each of the three pumps is the permanent testing system of the Station. The three close together are between the Weir meter and the measured water returns pump; the 6-inch check valve and 6-inch gate valve above are in the circulating lines to the test condenser.

Simplicity and durability, resulting from designs which are the growth of thirty years' experience in manufacturing power plant accessories, lead to the selection of Pratt & Cady Valves for this important share in the extensive valve equipment of the Station.

We will gladly furnish full particulars regarding all these valves and others which we manufacture.

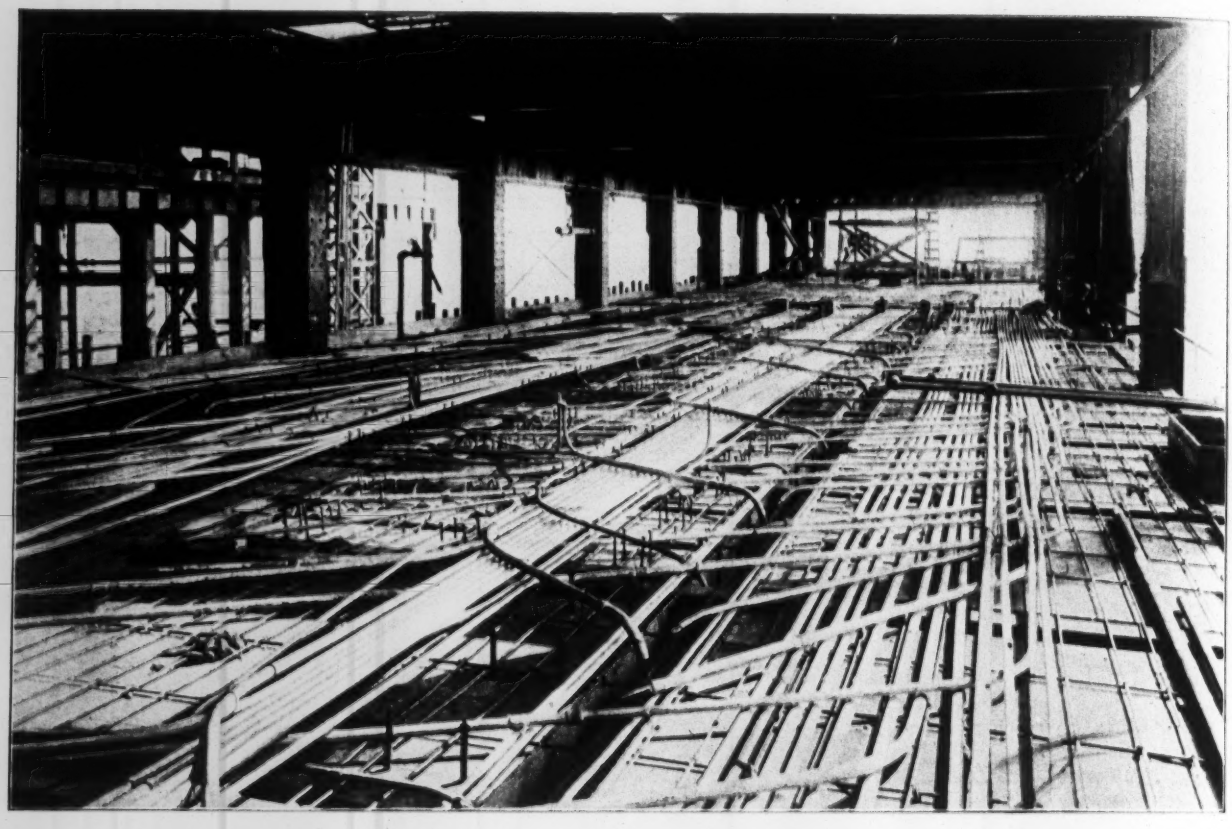
PRATT & CADY COMPANY, INC.

Makers of Valves, Cocks, Steam Traps and Hydrants

HARTFORD - - - - - - CONNECTICUT

NEW NIAGARA RIVER POWER STATION

100,000 Feet of "Alumaduct" Conduit



This is beneath the switchroom floor where the electrical circuits of the Niagara River Station are mobilized. They are led through 100,000 feet of "ALUMADUCT" varying from ½ inch to 2½ inches in size. The contract also included all the fittings.

"ALUMADUCT" is coated with an alloy of such density and homogeneousness that no further coat such as enamel or paraffine is needed as protection against corrosion. The inner surface is coated with the same enamel as "Enamelduct".

"ENAMELDUCT" has two distinct coatings baked on the tubing, making it the most carefully prepared Black Enameled Conduit on the market.

"ARMYDUCT" is a Rigid Iron Conduit made by a new patented process of hot galvanizing. One of the features of the process is the elimination of the possibility of corrosion after cleaning and before galvanizing. The threads are treated so that they are impervious to corrosion. "ARMYDUCT" is the conduit for extreme conditions of exposure and dampness.

Manufacturers of Conduits

NATIONAL ENAMELING AND MANUFACTURING CO.

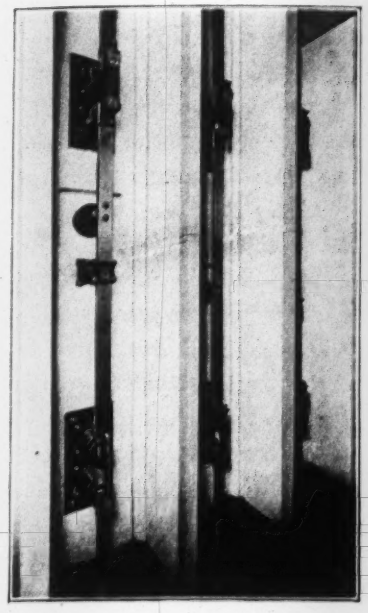
"ALUMADUCT" GALVANIZED

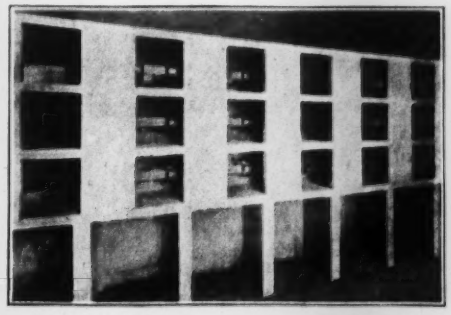
"ENAMELDUCT" ENAMELED

PITTSBURGH, PA.

NIAGARA'S 200,000 KILOWATT STEAM ALLY

Bus-Bar Supports and Disconnecting Switches





Left: 12,000 Volt Disconnecting Switches. Upper Center: Main Bus Supports, Front View. Lower Center: Main Bus, End View Right: Galley and Switch Compartments

The main busses in the NIAGARA RIVER STATION are carried exclusively on "Franklin" insulator posts manufactured by the Electrical Development and Machine Company. This Post is built for hard service and has many exclusive features. Materials and workmanship are the best and every expense and care is taken which would add to its reliability under extreme conditions. The contour of the porcelain and the top and base members is free from all projections that might induce static discharge. There are no dirt pockets and cleaning is simple.

The "Franklin" method of fastening the metal parts is original and gives very high cantilever and tensile strength. The collar on insulator is a metal composition and is driven around the porcelain under high pressure by a special device. The operation results in a most intimate contact between surfaces. All screws, clamping bolts and nuts are avoided by threading the outer surface of the collar, screwing on the outer member and jamming it home on a flexible cushioning washer. There is a maximum holding surface and absolute freedom from uneven clamping pressures or loosening of parts. The attachments for the support of the bus bars are screwed into the outer member and locked in place by a small countersunk locking screw, thus preventing the top or base attachment from loosening.

The disconnecting switches controlling the 12,000 volt lines are also our manufacture. They are of 300 amperes capacity and are mounted on steel bases and provided with locks, a special feature of our manufacture which insures against their being blown open in case of short circuits.

ELECTRICAL DEVELOPMENT AND MACHINE COMPANY

PHILADELPHIA, PA.

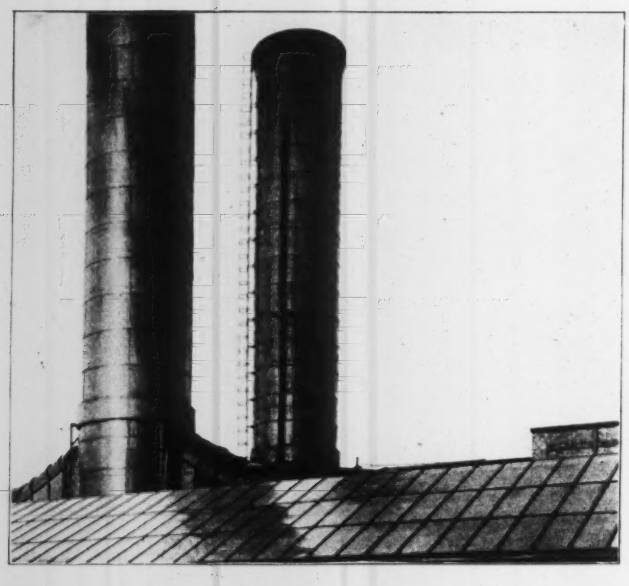
SELLING AGENTS

The Philadelphia Electric Company Supply Department

132 S. Eleventh Street - - - Philadelphia, Pa.

NEW NIAGARA RIVER POWER STATION

9,500 Square Feet of Skylight



This shows the double-pitch Lupton Rolled Steel Skylight, measuring 6,200 square feet, over the turbine room floor of the Niagara River Station. It is one of the twelve Lupton Skylights which here light and protect millions of dollars' worth of fine machinery.

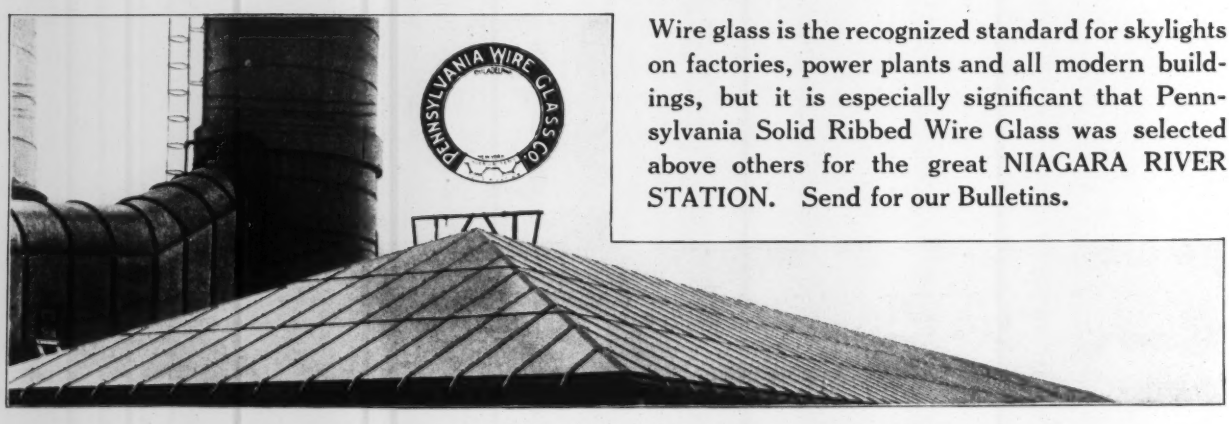
Lupton Rolled Steel Skylight is built to avoid breakage, leakage, and deterioration by corrosion. The skylight bar and cap are formed to receive glass lap, and the glass is cushioned between strands of specially saturated oakum. Condensation is fully drained. All metal parts exposed to weather are copper or brass. Being correctly designed, Lupton Skylight can safely be used over the most costly equipment.

No. 9 Catalogue, showing full line of Lupton Sash Products, will be sent on request.

DAVID LUPTON'S SONS COMPANY

Tulip and Westmoreland Streets — Philadelphia, Pa.

Pennsylvania Solid Ribbed Wire Glass in the Skylights



Wire glass is the recognized standard for skylights on factories, power plants and all modern buildings, but it is especially significant that Pennsylvania Solid Ribbed Wire Glass was selected above others for the great NIAGARA RIVER STATION. Send for our Bulletins.

Turbine Room Skylight Containing 6200 Square Feet of Pennsylvania Ribbed Wire Glass

PENNSYLVANIA WIRE GLASS CO.

New York Office
70 Fifth Ave.

Pennsylvania Building, Philadelphia, Pa.

Works
Dunbar, Pa.

Advertisers' Index and Reference

NIAGARA RIVER STATION CAMPAIGN . . . . . ALL MEDIUMS

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Westinghouse Electric & Manufacturing Co.	Pages 22-23	Pages 22-23			

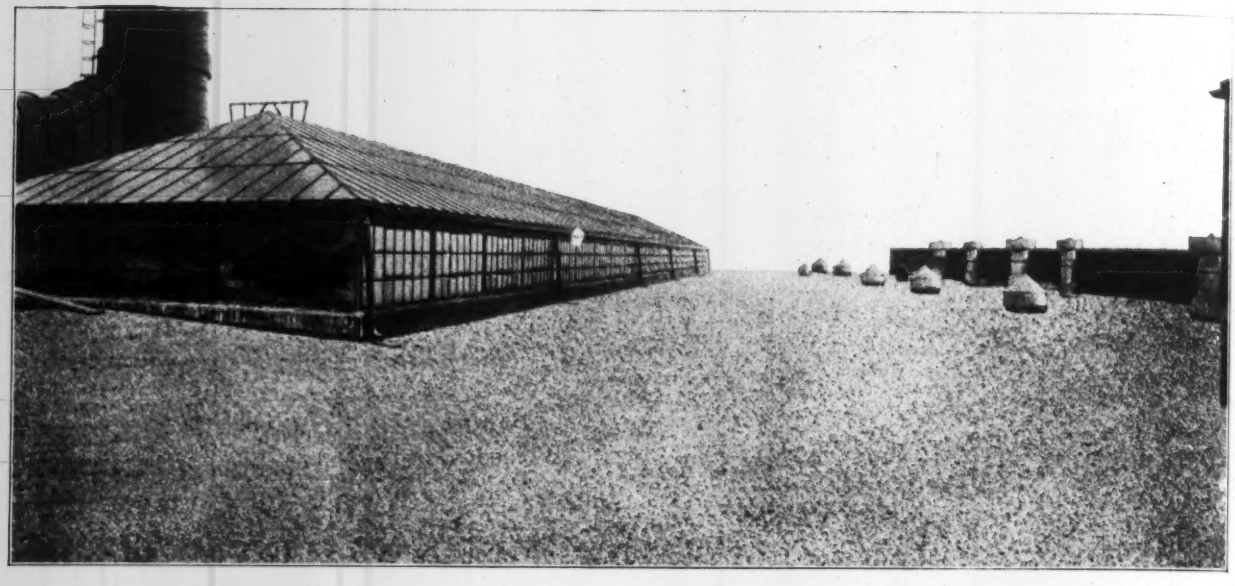
The photographs directly reproduced in the NIAGARA RIVER STATION CAMPAIGN and the photographs and engineering drawings used as the bases for such special illustrations as the Turbine Room for the General Electric Company and the Coal Handling for the Mead-Morrison Manufacturing Company were obtained with the help and through the courtesy of the Stone & Webster Engineering Corporation, the Buffalo General Electric Company, the Lackawanna Steel Company and others. The data specifically relating to the Station was placed at our disposal in large part through courtesy of the Stone & Webster Engineering Corporation.

March 15, 1917

Barrett Smith, Advertising Engineer
Boston, Mass.

NEW NIAGARA RIVER POWER STATION

Barrett Specification Roofs Cover This Great Power Station



The huge NIAGARA RIVER POWER STATION, which has been built in the most modern and scientific manner, is covered with a Barrett Specification Roof.

This is not to be wondered at; in fact, the wonder would be if some other type of roof had been specified, because most of the permanent structures of the country carry this roofing.

This preference is due to the fact that such roofs cost less per year of service than any other kind; that they are free from all maintenance expenses; that they are approved as "Class A" construction and take the base rate of fire insurance.

In addition to this, Barrett Specification Roofs are now guaranteed for twenty years.

This combination of twenty-year Guaranty with low cost and low insurance rate has put this roofing in a class by itself.

Guaranteed for 20 Years

We are now prepared to give a 20-Year Surety Bond Guaranty on every Barrett Specification Roof of fifty squares and over in all towns in the United States and Canada of 25,000 population and more, *and in smaller places where our Inspection Service is available.*

This Surety Bond will be issued by the United States Fidelity and Guaranty Company of Baltimore and will be furnished by us *without charge.* Our only requirements are that the roofing contractor shall be approved by us and that The Barrett Specification, dated May 1, 1916, shall be strictly followed.

A copy of The Barrett 20-Year Specification, with roofing diagrams, sent free on request.

Barrett Specification Roofs

Largest Manufacturers in the World of Roofing and Roofing Materials

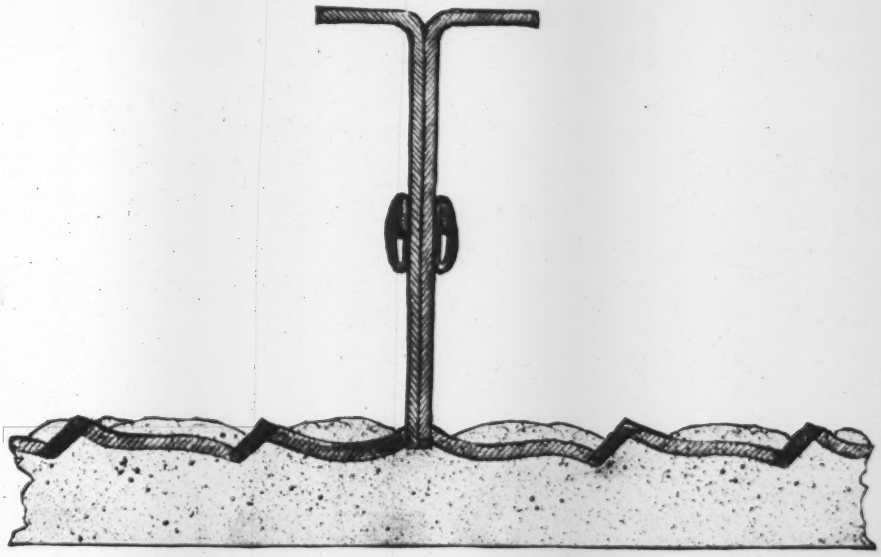
The Barrett Company

Largest Manufacturers in the World of Roofing and Roofing Materials

New York Chicago Philadelphia Boston St. Louis Cleveland Cincinnati Pittsburgh
Detroit Birmingham Kansas City Minneapolis Nashville Salt Lake City Seattle Peoria

The Paterson Manufacturing Company, Limited: Montreal, Toronto, Winnipeg, Vancouver, St. John, N. B., Halifax, N. S., Sydney, N. S.

TRADE B MARK



You Can Plaster the *Under* Side *Before* You Pour the Concrete

This is Point No. 6

There are 6 other reasons *why*

CHANELATH

is the Best ribbed mesh reinforcing

In roof and floor slab construction there is often a big advantage in being able to protect the floor beneath the slab from drip and leakage.

The T-Rib construction of Chanelath makes it possible to plaster the under side of the fabric because the T-Rib anchors the steel into the concrete firmly, even if the meshes of the fabric are filled with plaster. This is possible in any type of construction where it is not necessary to tamp the concrete.

The obvious advantages of this new type of rib reinforcing are bound to appeal to you. If you are not thoroughly familiar with the other six points, let us send you "Chanelath Hand Book."

Ask for booklet 404

North Western Expanded Metal Lath Co.

Manufacturers all Types of Expanded Metal

940 Old Colony Bldg., Chicago, Ill.

The Panama Canal, Catskill Aqueduct and New York State Barge Canal were built and are being operated almost exclusively by G-E Apparatus

Inevitably—you will electrify

SOONER OR LATER the advantages of G-E MOTOR DRIVE are going to become so apparent, that you will ask our Engineering Organization to study the conditions and requirements of your plant—just as the owners of the equipment here illustrated asked us to do.

For of course you want to know how you can cut the costs of production—how you can save on your POWER costs—how you can increase the QUALITY of your output, and how you can increase its QUANTITY.

In *every* field of activity where power is used, transmitted or generated, the trademark of G-E Initiative and Quality is found. In power stations of far-off mountains you will find G-E apparatus built to meet the special need. You will find the "G-E" trade-mark on the electrical equipment of the Panama Canal and on the locomotives which tow the ships through. The electrification of the railways which carry the commerce of the nation east and west across the Rockies is a tribute to G-E engineering skill. Manufacturing plants, large and small, in all sections of the country, enjoy marked advantages in production over their competitors because the General Electric Company has solved their power problems. All that has been learned in each individual field of electrical endeavor is transmitted through the great Research Laboratories of the company to its engineers in all departments, so that in the solving of *your* problems *you* may have the benefit of all the knowledge and experience that has gone before.

And because the General Electric Company possesses specific, definite knowledge of all the intricacies, puzzles and problems of industrial power, and applies to their solution the knowledge which no other organization can boast, G-E service is the greatest guarantee of results that you can possibly have. The organization and resources of the General Electric Company stand squarely behind every G-E MOTOR DRIVE to insure satisfactory operation.

G-E Motor Drive

GENERAL ELECTRIC COMPANY

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Construction News

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RAILWAYS—STEAM AND ELECTRIC

Proposed Work

New York—Union Railway Co., New York, (Bronx), applied to Bd. Estimate and Apportionment for permission to construct and operate double-track extension from line in West 207th St. along Amsterdam and Nagle Ave. and Dyckman St. to right-of-way of New York Central R.R. at foot of Dyckman St., Manhattan. H. A. Carrigan, Boston Rd. and 176th St., Bronx, Supt.

New Jersey—Central R.R. of New Jersey plans line from Bridgeton to Deerfield. A. E. Owen, 143 Liberty St., New York, Ch. Engr.

New Jersey—Pennsylvania R.R. purchased 20 acres land along present right-of-way at Kearny (Arlington post office), from Hackensack River westward and will build additional freight handling tracks. A. C. Shand, Broad St. Station, Phila., Ch. Engr.

Pennsylvania—Baltimore & Ohio Railroad Co. plans to improve and extend yards at Johnstown. R. N. Begien, Baltimore, Ch. Engr.

Pennsylvania—Lancaster, Oxford & Southern Ry. plans to improve and extend system in Lancaster. G. V. Wagner, Oxford, Gen. Mgr.

Pennsylvania—Lehigh & New England R.R. making surveys extending line from Nesquehoning to Coalport, about 5 mi. Line will run in Panther Creek Valley and cross Lehigh Valley R.R. on bridge to be built near Coalport. E. H. Shipman, South Bethlehem, Supt.

Pennsylvania—Lehigh Valley Transit Co., Allentown, plans to spend about $135,000 for improving lines. C. E. Jenkins, 14th and Gordon St., Allentown, Engr. M. W.

Maryland—Ocean City & Fenwick Ry. made plans trolley line between Ocean City and Fenwick Island, about 11 mi. C. E. Shute, Ocean City, Secy. Noted Feb. 15.

Maryland—Pennsylvania R.R., Baltimore & Ohio Railroad Co., Western Maryland R.R., and Maryland & Pennsylvania R.R. plan belt line railway in Baltimore to connect all lines entering city. Proposed line would start near Relay and extend southwest through city. Plans include 2 tunnels and terminal yard in Jones' Fall Valley to be built by Pennsylvania R.R. About $16,000,000. A. C. Shand, Broad St. Station, Phila., Ch. Engr. Pennsylvania R.R. R. N. Begien, Baltimore, Ch. Engr., Baltimore & Ohio Railroad Co. Noted Feb. 1.

North Carolina—Southern Ry. authorized by Georgia Railroad Comn. to sell $4,000,000 bonds for double-tracking line from Charlotte, N. C. to Spartanburg, S. C. W. H. Wells, 1300 Pennsylvania Ave., Wash., D. C., Ch. Engr. Constr. Noted Mar. 8.

Alabama—Northern Alabama Traction Co. plans interurban line from Florence to Huntsville, about 20 mi. W. R. Spear, 2nd Ave., New Decatur, Supt. and Pur. Agt.

Tennessee—(Official)—Gulf, Mobile & Northern Ry. receiving bids Apr. 2 grading 20-mi. proposed line from Middleton to Jackson. About $175,000. R. P. Parker, Jackson, Engr.-in-charge. Noted Feb. 1.

Tennessee—Tennessee Iron and Railway Co., Maryville, making surveys extending lines in Wayne and Hardin County, about 70 mi. Oliver Contracting and Engineering Co., Maryville, Engr.

Kentucky—Louisville & Nashville R.R. made surveys branch from Chavies to new properties of Crovona Coal Co., about 2 mi. W. H. Courtenay, Louisville, Ch. Engr.

Ohio—Mahoning & Shenango Railway and Light Co. applied to Council for franchise to extend Mahoning Ave. line in Youngstown. R. T. Sullivan, Youngstown, Mgr. of Rys.

Indiana—Bucklen Valley Line plans to extend line between Angola, Ind., and Montpelier, Ohio, and may electrify same. J. W. Fieldhouse, Trustee.

Kansas—E. C. Newby, Editor Randolph Enterprise, Randolph, submitted proposition to Chamber of Commerce, Topeka, for interurban railway from Greenleaf to Topeka, about 100 mi. Proposed line would pass through half Shawnee, Riley, Pottawatomie and Washington Counties.

Montana—Minneapolis, St. Paul & Saulte Ste. Marie Ry. plans extending line from Whitetail, Mont., to Coutts, Alta, Canada. C. N. Kalk, 317 2nd Ave., Minneapolis, Minn., Ch. Engr.

Texas—Bartlett Western Ry. recently purchased by T. Cronin, Palestine, and associates, will be extended from Bartlett west to Lampasas, about 25 mi. and from Florence east to Rockdale, 25 mi.

Texas—Houston & Texas Central R.R. acquired right-of-way for belt line around Ft. Worth. G. S. Wald, Houston, Vice-Pres. and Gen. Mgr. Noted Oct. 5.

Texas—Jefferson County Traction Co., subsidiary of Eastern Texas Electric Co., granted franchise to improve trackage on Waco and Austin Ave., Port Arthur. E. J. Emerson, Beaumont, Mgr. Oper. Cos.

Texas—San Antonio & Aransas Pass Ry. plans to extend line from Falfurrias to Hidalgo on Rio Grande River, about 100 mi. J. S. Peter, San Antonio, Vice-Pres. and Gen. Mgr.

California—Atchison, Topeka & Santa Fe Ry. making surveys new line from point 2 mi. west Fullerton through La Habra, Brea and Yorba Linda Valley to connect with Olinda-Santa Fe line. F. M. Bisbee, Amarillo, Tex., Ch. Engr. Western Lines.

British Columbia—British Columbia Electric Railway Co., Ltd., plans 1 mi. new track along North Burquitlam Rd., Vancouver. G. Kidd, Hastings & Carroll St., Vancouver, Gen. Mgr.

Bids in and Contracts Awarded

North Dakota—Chicago, Milwaukee & St. Paul Ry. plans to extend line from New England to Amidon. Grading for line to be done by company's forces. C. F. Loweth, Railway Exchange Bldg., Chicago, Ch. Engr. Noted Feb. 8.

California—Municipal Railway of San Francisco, San Francisco, let contract extending line from Van Ness Ave. and Market St. to 16th and Church St. to WESTERN MOTOR DRAYAGE CO., about $74,431.

LIGHT, HEAT AND POWER

Proposed Work

Mass., Salem—Salem Electric Lighting Co., 72 Washington St., plans 2-story, 60 x 114-ft. brick and rein.-con. plant on Peabody St. About $50,000.

N. Y., Akron—State Legislature passed bill authorizing $19,000 bond issue to install electric-light plant and street-lighting system.

N. Y., Auburn—Auburn Theological Seminary made plans boiler house. Robinson & Hill, Jr., Seward Bldg., Arch.

N. Y., Buffalo—East Buffalo Brewing Co., 300 Emslie St., plans boiler house. J. C. Schultz, 1370 Main St., Arch.

N. Y., New York—(Manhattan)—Eagle Pencil Co., 710 East 14th St., made plans alteration to 1-story, brick boiler room, 703-731 East 13th St. About $5500. R. J. Mansfield, 134 William St., Arch.

N. Y., New York—(Manhattan)—Manhattan Railway Co., 165 Broadway, made plans alterations to 3-story, 40 x 204-ft. brick power plant, 503 East 74th St., to be leased to Interborough Rapid Transit Co., 165 Broadway. About $20,000.

N. Y., Whitney Point—Union Electric Co. plans to install concrete dam during summer and change system from 133 to 60 cycles. D. O'Connell, Pres. and Mgr.

Pa., Altoona—Penn Central Light and Power Co. plans to spend $120,000 to improve system. H. A. Crownover, 1412 11th Ave., Pur. Agt.

Pa., Bloomsburg—Electric Bond and Share Co., 71 Broadway, New York, recently acquired plant of Northern Central Co., and plans additions and improvements including power plant for mill and industrial works operation.

Pa., Erie—Erie Lighting Co., 11th and State St., soon receives bids 1-story, 200 x 230-ft. power plant. About $1,000,000. Day & Zimmerman, 611 Chestnut St., Phila., Engr. Noted Mar. 22.

Pa., Hazleton—Lehigh Valley R.R. plans electric plant for shop operations. E. B. Ashby, 134 Liberty St., New York, Ch. Engr.

Pa., Quakertown—City purchased site for power plant and will install engine generators, boilers, etc. G. E. Willard, Supt.

Pa., Sharon—Shenango Valley Electric Light Co., 63-65 State St., plans addition to substation on Silver St. C. O. Bailey, Youngstown, Pur. Agt.

Ga., Davidsboro—City retained W. M. Crook, Engr. Grand Bldg., Macon, to make plans electric-light plant.

Ga., Eastman—Plant of Eastman Light and Ice Co. sold to Marshall & Co., who will improve same.

Ga., Statesboro—See item under "Streets and Roads."

Fla., Fellsmere—City plans electric-light plant including 50-hp. oil engine and suitable generator. G. E. King, Comr.

Ala., Montgomery—Montgomery Light and Water Power Co., 111 Dexter Ave., plans extending transmission system to Wetumpka. R. C. Adams, Mgr.

La., Kenner—City receiving bids Apr. 9 electric-light and power plant.

Tenn., Centreville—See item under "Water Works."

Ohio, Bluffton—City voted $35,000 bonds to improve electric-light and water plant. Noted Jan. 25.

Ohio, Cleveland—Cleveland Electric Illuminating Co. made plans 2-story, 50 x 60-ft. substation, 817 East 103rd St. About $35,000. W. H. Hartman, 711 Cuyahoga Bldg., Pur. Agt.

Ohio, St. Mary's—City plans improving electric-light plant and water works. About $61,000. C. L. Selby, Supt.

Ohio, Wilmington—Wilmington Gas Light and Coke Co. making plans addition to gas plant. About $25,000.

Ind., Gary—Gary Heat, Light and Water Co. made plans 40 x 40-ft. substation. About $12,000. A. F. Wicks, Arch. Noted Mar. 22.

Ind., Griffin—City voted bonds to install electric-light plant.

Ind., Lafayette—City plans electric-light plant in connection with water works. H. B. Overeach, City Engr.

Ind., Stroh—Stroh Cement Co. reported interested in project to install electric-light plant in city.

Ill., Chicago—Illinois Northern Utilities Co. plans 75 x 100-ft. steam power plant. About $300,000. E. D. Alexander, Vice-Pres.

Ill., Chicago—Peoples Gas, Light and Coke Co., 122 South Michigan Ave., making plans gas plant, 31st St. and drainage canal. J. H. Eustace, Engr.

Ill., Chicago—Turner Manufacturing Co., 1444 South Sangamon St., making plans 2- and 3-story, power house and dry kiln on Ogden Ave., between Keeler and Kedvale Ave. About $150,000. A. S. Alschuler, 20 East Jackson Blvd., Arch.

Ill., Montgomery—Montgomery Light and Power Co. made plans hydro-electric plant, involving rein.-con. dam and a 10,000-kv.a. generator. C. Haywood, New Richmond, Mgr. H. E. Strauss, 111 West Washington St., Chicago, Engr.

Wis., Clintonville—Water and Light Comn. made plans 1-story, 40 x 60-ft. boiler house. G. C. Stewart, Supt.

Wis., Kaukauna—Municipal Electric and Water Dept. plans hydro-electric plant to develop about 7000 hp. under a 26-ft. head, using vertical generators. W. B. Montgomery, Mgr.

Minn., Faribault—City making plans electric-light plant. F. W. McKellip, City Engr.

Minn., Hibbing—City retained Tyrie & Chapman, Auditorium Bldg., Minneapolis, to make plans 1-story power house. About $200,000. D. D. Haley, City Clk.

Minn., Rochester—City receiving bids Apr. 2 hydraulic power plant and dam. A. F. Wright, City Clk.

Kan., Alma—Alma Light and Ice Co. plans electric transmission line. G. D. Page, Mgr.

Kan., Bison—City plans electric-light plant and will erect transmission line to La Crosse to obtain electricity to operate system.

Kan., Cherryvale—Cherryvale Electric Co. receiving bids Apr. 1, 1-story, 34 x 50-ft. electric generator station. About $7000. F. F. Fletcher, 112½ East Myrtle St., Independence, Engr.

Kan., Independence—City to vote Apr. 3 on $75,000 bond issue to install electric-light plant. D. Weaver, Engr.

Kan., Irving—City plans election to vote on $7000 bonds for distribution and lighting system and transmission line to Blue Rapids.

Light, Heat and Power (Continued)

Kan., Munden—City Council plans electric-light plant. About $30,000.

Neb., Litchfield—City voted $7000 bonds to install electric-lighting system.

S. D., Marvin—City plans electric-lighting system.

Mont., Livingston—City plans electric-light plant.

Mo., Kansas City—Kansas City Light and Power Co., 1500 Grand Ave., soon receives bids power plant. About $6,000,000. J. H. Lucas, Pres. Noted Mar. 1.

Mo., St. Louis—Sisters of Mercy, 307 South Euclid Ave., soon receive bids 2-story, 40 x 50-ft. boiler house and laundry. About $40,000. Barnett, Haynes & Barnett, Century Bldg., Arch.

Ark., Gillham—B. & A. Mining Co. plans hydro-electric plant.

Ark., Mansfield—Coal Dist. Power Co. plans improving electric plants in Mansfield, Greenwood, Huntington and Hartford and will install $75,000 worth of machinery.

Ark., Paris—City retained Winters & Dove, Ft. Smith, to make surveys installing electric-light plant and water-works.

Ark., Pine Bluff—Pine Bluff Co. plans extending high-tension transmission lines to Stuttgart, England and other towns and cities.

Okla., Gate—City issued $7000 bonds to install electric-lighting plant.

Okla., Headrick—City plans electric-lighting system.

Nev., Reno—Nevada Valleys Power Co., 410 1st National Bank Bldg., Oakland, Calif., plans generating plant to develop 2500 hp. J. G. Brown, Oakland, Vice Pres. and Gen. Mgr.

Wash., Lacrosse—H. G. Wilson applied to Council for franchise to install and operate electric-light and power plant.

Calif., Oakdale—Sierra & San Francisco Power Co., 58 Sutler St., San Francisco, plans substation. About $10,000. L. C. Helfridi, Pur. Agt.

Calif., Oroville—Great Western Power Co., 14 Sansome St., San Francisco, plans power plant, including concrete-lined canal 15 mi. long, 25 ft. wide, 14 ft. deep. Water will be obtained from north fork of Feather River near mouth of west branch. Plant will develop 75,000 kv.-a. About $6,000,000.

Calif., San Francisco—Pacific Gas and Electric Co., 445 Sutler St., plans substation, Lexington Ave. and 19th St. About $38,000. J Britton, Vice-Pres. and Gen. Mgr.

Calif., Wasco—San Joaquin Light and Power Corp. making plans and estimates for lighting system. G. O. Newman, Los Angeles, Ch. Engr.

Ont., Aylmer—City will install hydro-electric and power distributing system. E. A. Coughill, Chn. Light Comn.

B. C., Nelson—City plans addition to 3d unit of power plant. W. E. Wasson, City Clk.

Bids In and Contracts Awarded

N. Y., Rochester—Haloid Co. let contract power house to W. SUMMERHAYS & SON, 1 Exchange St.

N. Y., Solvay—Niagara & Lockport & Ontario Power Co., Bridge St., let contract rebuilding transformer station to TAYLOR-HORNSBY CONSTRUCTION CO., 115 South Salina St., Syracuse.

Pa., Phila.—R. H. Foerderer, Wheatsheaf Lane and Coral St., let contract addition to boiler room to G. KESSLER CONSTRUCTION CO., Drexel Bldg., $40,000.

BRIDGES

Proposed Work

N. J., Elizabeth—Union County receiving bids Apr. 4, new Straus Bascule bridge over Elizabeth River, South Front St. J. L. Bauer, Elizabeth, County Engr.

N. J., Freehold—Bd. Freeholders Monmouth County receiving bids Apr. 4, replacing Seabright drawbridge. C. E. Close, Matawan, County Clk.

Pa., New Wilmington—Boro plans bridge across Nelson Run on North Market St.

Pa., West Chester—Chester County receiving bids Apr. 2, 4 arch masonry bridge over Brandywine Creek, Rock Run, Valley Township. I. Y. Ash, Controller.

Del., Wilmington—State Assembly approved $100,000 bonds to build bridge across Brandywine Creek.

N. C., Newton—Catawba and Iredell Counties receiving bids Apr. 9 substructure Island Ford and Buffalo Shoals bridges over Catawba River. Address County Clk., Newton.

S. C., Camden—Kenshaw County plans to build bridge over Waterlee River. Address County Clk., Camden.

Ga., Oglethorpe—Macon County voted $100,000 bonds to build and improve bridges. A. H. Perry, Oglethorpe, County Clk. Noted Mar. 8.

La., Baton Rouge—(Official)—East Baton Rouge and Livingston Parishes receiving bids Apr. 10, 300-ft. steel bridge across Amite River. T. C. Foreman, Baton Rouge, Chmn. of Com. Noted Jan. 25.

Ky., Frankfort—Bracken County receiving bids Apr. 3 steel bridge over Locust Creek on Augusta Rd. near Brookville, 150 cu.yd. sandstone, 3080 lb. reinforcing steel, 28,240 lb. structural steel. R. Wiley, Frankfort, Comr.

Ky., Lexington—Fayette County Road Dept. making surveys steel bridge over Kentucky River at Clay's Ferry. R. W. Davis, Lexington, Engr.

Ohio, Hamilton—Butler County made plans culverts along Caldwell Rd. A. Hammerle, Hamilton, County Engr.

Ohio, Tiffin—(Official)—Seneca County Comrs. receiving bids Apr. 7, Wolf Creek Bridge No. 212, Liberty Township, additional joists, wood plank and creosoted block floor, etc., Spayde Bridge No. 30, Thompson Township, rein.-con. J. E. Hershberger, Tiffin, County Audr.

Ind., Columbus—Bartholomew County receiving bids Apr. 4, 3 bridges Wayne Township. W. M. Scott, Columbus, County Audr.

Ind., Ft. Wayne—(Official)—Allen County rejected bids State St. bridge. New bids. A. W. Grosvenor, Ft. Wayne, County Surv.

Ind., Hartford City—Hartford County lets contract in April 5 bridges. Address County Clk., Hartford City.

Ind., Huntington—Huntington County receiving bids Apr. 10, 6 rein.-con. bridges and culverts, also repairing 8 bridges. O. E. Eviston, Huntington, County Audr.

Ind., Salem—Washington County receiving bids Apr. 3 reflooring South Boston bridge, Franklin Township. Address County Clk., Salem.

Ill., Lewistown—(Official)—State Highway Comn., Springfield, receiving bids Apr. 11, 1 steel span at 140-ft. and 1 rein.-con. span at 35-ft.; roadway 18-ft.; height 29 ft. known as Indian Ford Bridge. Noted July 13.

Ia., Le Mars—Plymouth County receiving bids about Apr. 15 concrete culverts. J. M. Hayes, Le Mars, County Audr.

Ia., Rock Rapids—E. J. Riegel, Audr Lyons County, receiving bids Apr. 10, 88 concrete box culverts and 4 16-ft. slab bridges. W. C. Wycoff, Rock Rapids, County Engr.

Minn., Grand Rapids—O. J. Lidberg, Itasca County Engr., making plans estimating cost bridge over East Arm Pokegama Lake.

Minn., Mankato—City voted $5000 bonds for bridges. H. F. Bloomquist, City Engr.

Minn., Minneapolis—City plans to vote on $100,000 bonds to build bridges.

Minn., Pine City—See item under "Streets and Roads."

Minn., Warren—See item under "Canals, Ditches and Irrigation."

Kan., McPherson—McPherson County Comrs. plan bridges. About $6000. Address County Clk., McPherson.

Neb., North Platte—City, Lincoln County, and State plan to build bridge over South Platte River. About $40,000. City election Apr. 5 to vote on $10,000 bonds to pay its share toward same. O. E. Elders, City Clk.; C. W. Yost, North Platte, County Clk.; G. W. Johnson, Lincoln, State Engr. Noted Nov. 9.

N. D., Schaffer—McKenzie County receiving bids Apr. 3 steel culverts. O. P. Benson, Schaffer, County Audr.

Ark., Morrillton—Conway County retained J. L. Harrington, Orear-Leslie Bldg., Kansas City, Mo., to make plans highway bridge. Address County Clk., Morrillton.

Tex., Dallas—See item under "Streets and Roads."

Okla., Pauls Valley—See item under "Streets and Roads."

Ariz., Florence—See item under "Streets and Roads."

Wash., Yacolt—Clarke and Cowlitz Counties plan bridge over Lewis River near Yacolt. About $14,000. Address Clk. Clarke County, Vancouver.

Calif., Glendora—City making plans 2 concrete bridges over Dalton Creek. O. A. Gierlich, El Monte, Engr.

Calif., Princeton—Colusa County making plans bascule bridge. About $226,000. Address County Clk., Colusa.

Que., St. Tite—Village Council plans 4 bridges. About $10,000. Engr. J. E. Valee, c/o J. Coutler, Secy.-Treas.

Que., Ste. Ursule—M. L. Louis, Secy.-Treas. of Council, receiving bids in summer steel bridge over Maskinonge River.

Bids In and Contracts Awarded

Mass., Worcester—New York, New Haven & Hartford R.R. let contract Cambridge St. bridge to AMERICAN BRIDGE CO., 30 Church St., New York.

N. J., Camden—Victor Talking Machine Co. let contract bridge connecting Building No. 1 and 18A to IRWIN & LEIGHTON, 126 North 12th St., Phila., $9000.

Pa., Corry—City let contract steel and concrete bridge to C. F. BROWN, $18,000.

W. Va., Charleston—(Official)—Kan[illegible] County let contract bridge over Big Sandy [illegible] near Clendenin to VIRGINIA BRIDGE AND [illegible] CO., Roanoke, $8849. Noted Feb. 22.

Fla., Ft. Myers—Lee County Caloosah[illegible] Valley Highway Special Road and Bridge [illegible] let contract steel and concrete bridge over [illegible] Creek to W. R. WALLACE & CO., $11,940.

Ohio, Brewster—Stark County let con[illegible] Wabash Ave. bridge to MASSILLON BRI[illegible] AND CONSTRUCTION CO., $5550.

Ohio, Columbus—Franklin County let con[illegible] bridge over Olentangy River to WATSON ENG[illegible] NEERING CO., Engineers Bldg., Cleveland. A[illegible] $80,000. Noted Feb. 22.

Ind., Anderson—Madison County let cont[illegible] bridge over Lick Creek to T. P. KELLY & SO[illegible] Anderson, $4875.

Ill., Blue Island—(Official)—Sanitary Dist. [illegible] Chicago, 910 South Michigan Ave., Chicago, re[illegible]ceived low bids Mar. 22, furnishing, fabricating and delivering steel superstructures of 4 plate girder railway bridges, (a) Alternative 1, work on each bridge separately, (b) Alternative 2, work on all bridges under 1 contract, as follows: Strobel Steel Construction Co., 53 West Jackson Blvd., Chicago, (a) $148,382, (b) $145,237; Ketler-Elliott Erection Co., 155 North Clark St., Chicago, (a) $151,314, (b) $149,519; Toledo Bridge and Crane Co., Toledo, (a) $153,403, (b) $153,403. Noted Mar. 15.

Ill., Des Plaines—(Official)—Cook County received low bid Senne Bridge from Walsh Construction Co., $4480.

Ill., Marion—Williams County let contract Crab Orchard and Creal Springs bridges, Marion Township, to A. P. POIROT, Belleville, $4575.

Wis., Lancaster—City let contract bridge over Fennimore River to LANCASTER BRIDGE WORKS, $5480.

Ia., Clinton—Clinton County let contract 46 bridges and culverts to J. R. KANE, $45,940. Noted Mar. 22.

Ia., Iowa City—Johnson County let contract steel bridge to IOWA BRIDGE CO., 712 Hubbell Bldg., Des Moines, $5377.

Ia., Mt. Pleasant—Henry County let contract 59 bridges and culverts to WHITNEY & BERGDAHL, Mt. Pleasant, $42,946.

Neb., Wayne—Wayne County let contract bridge work as follows; concrete work to NORFOLK BRIDGE AND CONSTRUCTION CO., Norfolk; steel work to STANDARD BRIDGE CO., Omaha. Noted Jan. 18.

S. D., Junius—City let contract steel and concrete bridge to M. BIJSMA, Winfred.

N. D., Grand Forks—Grand Forks County let contract steel and concrete bridges to JARDINE & ANDERSON, Fargo, $30,000. Noted Mar. 8.

Calif., Calexico—City let contract bridge over New River Channel to W. M. LEDBETTER CO., Pacific Electric Bldg., Seattle, $4414. Noted Feb. 8.

WATER-WORKS

Proposed Work

Mass., Chicopee—City plans improving water system. About $50,000. C. A. Bogardul, Supt.

N. Y., New York—(Manhattan and Richmond)—C. Strauss, Pres. Bd. Water Supply, 22nd Floor, Municipal Bldg., Park Row, Centre and Chambers St., receiving bids Apr. 10, Contract 176, furnishing and erecting about 3½-mi. spiral cloth or chain-link wire fencing and about 1-mi. rein.-con. guard rail, repairing wire fencing about 7 ft. high and erected on a galvanized steel pipe frame at Hill View Reservoir, Yonkers and Silver Lake Reservoir, Richmond.

Pa., Freemansburg—City plans water system. About $8000.

Md., Baltimore—City plans 10,000,000-gal. rein.-con. reservoir. D. Douglas, Supt.

Va., Altavista—Town sold $16,000 bonds to improve water and sewer systems and streets. W. S. Corbin, Clk.

Va., Newport News—Newport News Light and Water Co. plans to extend and improve water supply of cities of Newport News and Hampton. Plans include 3,000,000-gal pump, additional boilers, 16-in. mains from station No. 2 to Hampton, laying 6-in. mains from Hampton to government aviation field on Black River, etc. About $300,000.

W. Va., Martinsburg—City soon votes on $210,000 bonds for water system and improving streets. E. D. Bromley, City Engr.

N. C., Mebane—Town plans election to vote on bonds for water and sewer systems.

Ga., Statesboro—See item under "Streets and Roads."

Ga., Swainsville—City receiving bids about May 15, water system, $34,000.

Water-Works (Continued)

N. C., Raleigh—City plans to lay 5000 ft. 18-in. c.-i. pipe between pumping station and impounding reservoir. B. Bain, Supt.

Fla., Brooksville—City soon receives bids water system, including standpipe. About $20,000. Knight & McElroy, Tampa, Engr.

La., Shreveport—City plans laying water mains in portions of Gilbert, Walnut, Dove, Jordan, Sycamore, Gary, Yale, Cain, Caddo Magnolia, Portland, and Gilbert St., and Southern Ave. C. O. Lilley, City Clk.

Tenn., Centreville—City plans water and light plant.

Ky., Louisville—City plans improving water system. About $750,000. J. B. Wilson, Supt.

Ohio, Greenwich—F. H. Daniels, Clk. Bd. Trustees of Pub. Affairs, receiving bids Apr. 10, improving water-works, including addition to pumping station, 10-in. suction main, intake crib, concrete spillway and excavation in existing reservoir, etc.

Ohio, Middletown—City to sell $20,000 bonds Mar. 30 to improve water system. L. T. Nein, City Audr.

Ohio, Urbana—City retained Richards Engineering Co. to make plans and submit estimate cost of proposed water system. P. Glechler, Supt.

Ind., Kendallville—City making plans improving and extending water system. W. Shauch, Supt. G. Champe, 610 The Nasby, Toledo, Engr.

Ind., Marion—(Official)—Bd. Pub. Wks. receiving bids Apr. 6, furnishing and installing 1 cross-compound condensing air compressor and appurtenances at pumping station. C. E. Grant, Pres.

Ia., Imogene—City plans water system.

Mich., Detroit—City voted $100,000 bonds to extend water mains. W. A. Sperry, Supt.

Ill., Whitehall—City plans to vote on $20,000 bonds to extend water system.

Ia., Clinton—City plans water system. About $1,107,720. J. C. Thorne, City Clk.

Ia., Iowa Falls—City plans to improve water system including pumps and motors. W. D. Hostetter, Supt.

Ia., Murray—See item under "Sewers."

Minn., Stillwater—City voted $50,000 bonds to extend water mains. L. W. Clark, Supt.

Minn., Wadena—City voted $14,000 bonds to extend water system. G. S. Hughes, Supt.

Kan., Chanute—City making plans improving water system. About $100,000. C. Pratt, Supt. Black & Veatch, Interstate Bldg., Kansas City, Mo., Engr.

Kan., Yates Center—City election Apr. 3, to vote on $80,000 bonds to improve water system. F. Southard, Supt.

Neb., Indianola—City election Apr. 3, to vote on $12,000 bonds for water system. Grant & Fulton, 509 Bankers' Life Bldg., Lincoln, Engr.

N. D., Cooperstown—City receiving bids Apr. 9 water system.

N. D., Hankinson—J. F. Druar, Consult. Engr., 312-316 Commercial Bldg., St. Paul, made plans water-works system and submitted same to city for approval.

N. D., La Moure—City election Apr. 2, to vote on $10,000 bonds for water system.

N. D., Sherwood—City election Apr. 2 to vote on bonds building water system.

Ark., Piggott—City making plans water system. About $40,000. A. C. Moore, Frisco Bldg., Joplin, Mo., Engr.

Tex., Corsicana—City plans to issue $50,000 bonds to build additions to water system. C. B. Lewis, Supt.

Tex., Pleasanton—Town voted $20,000 bonds to build aqueduct water system.

Okla., Bixby—City plans to vote on $25,000 bonds for water system.

Okla., Okmulgee—City plans water-purification plant, new pumping station, extending water mains, sewerage-purification plant, intercepting sewers and new laterals. About $300,000. Benham Engineering Co., Colcord Bldg., Oklahoma, Engr.

Okla., Redrock—(Official)—Bd. Trustees receiving bids Apr. 5, water system including 8254-ft. 4- and 6-in. Class "B," c.-i. pipe, 7704-ft. 2-in. w.-i. pipe 6800 lb. special castings, fire hydrants, etc. J. M. Mitchell, Clk. Benham Engineering Co., Colcord Bldg., Oklahoma, Engr.

Okla., Skiatook—City sold $20,000 bonds to improve water system.

Ariz., Globe—City making plans extending water system. G. Cook, Supt., Benham Engineering Co., Colcord Bldg., Oklahoma, Consult. Engr.

Ore., Astoria—City receiving bids Apr. 13, 20,000,000-gal. reservoir. O. Anderson, City Clk.

Ore., Helix—Council plans water system.

Calif., Baldwin Park—Baldwin Park Domestic Water Co. plans to spend $54,000 extending and improving water system. S. M. Walker, Mgr.

Calif., Covina—City receiving bids Apr. 3, furnishing and installing chlorination plant or apparatus to treat 1,500,000-gal. water per 24 hours, also plant to treat 50,000-gal. water per day. D. S. Stafford, Clk.

Ont., Cayuga—City made plans extending water system. About $7500. Jackson & Lee, Temble Bldg., Brantford, Engr.

Ont., Long Branch—City plans water system, including meters, standpipe and 5-mi. water mains. About $67,000.

Ont., London—Utilities Bd., City Hall, making plans extending water system. About $47,000.

Man., Winnipeg—(Official)—Greater Winnipeg Water Dist., 501 Tribune Bldg., receiving bids Apr. 16 about 12,000 ft. 48-in. and 1300 ft. 60-in. c.-i. pipes, also numerous specials and gate valves. R. D. Waugh, Chn. of Comrs. (See adv.)

Bids In and Contracts Awarded

N. Y., Geneva—(Official)—City received low bids slow sand filter unit from SUBURBAN ENGINEERING CO., $31,929; SCHAAF CO., Buffalo, $34,058; J. H. RIPLEY, $26,298.

N. Y., New York—(Manhattan)—(Official)—Dept. Water Supply, Gas and Electricity let contract furnishing and delivering liquid chlorine for use at Kensico Screen Chamber of Catskill Aqueduct to ELECTRO BLEACHING GAS CO., 18 East 41st St., $5875.

N. J., Hawthorn—City let contract pumping plant to WATSON FLAGG ENGINEERING CO., New York, $31,759.

Pa., Charleroi—Tri-Cities Water Co. let contract water tube boilers for main pumping station to HEINE BOILER CO., Phoenixville.

Md., Baltimore—Bd. Prison Control let contract steel water tank to PITTSBURGH & DES MOINES STEEL CO., $7685.

Ohio, Ravenna—City received low bid filtration plant from Pittsburgh Filter and Manufacturing Co. J. S. Mallette, Supt.

Wis., Chilton—City let contract water system to HALLET & KUEHN, $8488.

Ia., Benson—City let contract extending water mains to P. N. KRUSE, Spencer.

Ia., Burlington—City let contract water tank and tower to DES MOINES BRIDGE AND IRON CO.

Ia., Council Bluff—City let contract 2-mi. water mains to HAMMOND-BYRD IRON CO., 1216 People's Gas Bldg., Chicago, $22,000.

Ia., Grinnell—City let contract laying water mains to J. W. TURNER IMPROVEMENT CO., Des Moines. Noted Nov. 23.

Kan., Lawrence—City let contract water system, exclusive of extensions to distribution systems and new boilers, as follows: KANSAS PAVING AND CONSTRUCTION CO., Kansas City, general contract; NEW YORK CONTINENTAL JEWELL FILTRATION CO., 15 Broad St., New York, filters, $35,000; AMERICAN WELL WORKS, 95 Liberty St., centrifugal pumps, H. R. WORTHINGTON, 115 Broadway, New York, steam pumps, LUDLOW CO., 62 Gold St., New York, hydrants and valves.

S. D., Castlewood—Town rejected bids water system including 100-ft. steel tower, 70,000-gal. steel tank, 8000-ft. 6 and 8-in. cast iron water mains. About $20,000.

N. D., Bowman—City let contract water system to HAGGERT CONSTRUCTION CO., Fargo, $23,000.

N. D., Grand Forks—City let contract water softening plant to PITTSBURGH FILTER MANUFACTURING CO., Pittsburgh, $14,707.

N. D., Mohall—City let contract water system to G. W. KEMPER, Minot. Noted Feb. 8.

Wash., St. John—City let contract water system to C. H. GREEN CO., Spokane.

SEWERS

Proposed Work

N. Y., Governeur—City plans sewer system.

N. Y., New York—(Manhattan)—M. M. Marks, Room 2032 Municipal Bldg., receiving bids Apr. 2 completion of alteration and improvement to sewer in portion 53rd St. and 3rd Ave. for which contract was abandoned by R. E. Fox, 81 East 125th St., on June 29, 1916.

N. Y., New York—(Queens)—M. E. Connolly, Boro. Pres., 4th Floor, Queens Subway Bldg., Hunterspoint and Van Alst Ave., receiving bids Apr. 4 receiving basin and appurtenances at Park Pl. and Pleasure Ave. and Mill and Franklin St., 1st Ward; sewer and appurtenances portions of Hull and Willow Ave., Hamilton Pl. and Grand St., Collins Ave., Adriatic St. and Fresh Pond Rd., 46th, 45th, 44th, 43d, 42d, 41st and 40th and Junction Ave., Hughes and Sedgwick St., Armand, Ridgewood, and McComb Pl. and Copeland Ave., 2d Ward; receiving basins and appurtenances in Madison St. and Woodward Ave. and Sedgwick St. and Catalpa Ave., in 2d Ward; sewers and appurtenances in Beaufort, Portland, Herald, Gwoin, Atlantic and Hatch Ave. and Emerson St., 4th Ward, and receiving basin and appurtenances at Metropolitan and Breevoort St., 4th Ward.

N. J., Newark—Bd. Works plans sewer system in Thomas St. M. R. Sherrard, City Engr.

N. J., Paulsboro—City retained Remington & Vosbury, Engrs., 6th and Market St., Camden, to make plans sanitary sewer system and treatment works.

Pa., Catawissa—Boro. Council plans sewage disposal plant. P. L. Volcker, Engr.

Pa., Upper Darby—Comrs. receiving bids Apr. 10 laying terra cotta pipe sewers. About $20,000. W. Pendlebury, Cardington, Secy.

Va., Altavista—See item under "Water-Works."

W. Va., Huntington—City plans trunk sewer in 9th St. About $75,000. A. B. Maupin, City Engr.

N. C., Hamlet—See item under "Streets and Roads."

N. C., Mebane—See item under "Water-Works."

Ga., Swainsboro—City receiving bids May 15 sewerage system. About $16,000. B. Scarboro, Supt. Noted Jan. 25.

Ala., Gadsden—City plans extending sewer system. About $25,000. E. Smith, City Engr.

La., Crowley—City Council rejected bids sewer. New bids. About $30,000.

La., Shreveport—City plans extending sewers in several streets. E. M. Turner, City Engr.

Ohio, Beloit—City receiving bids Apr. 9 sewage disposal plant and sanitary sewer.

Ohio, Canton—City plans sanitary sewer in portion 8th St. W. E. Sarver, City Engr.

Ohio, Centersburg—(Official)—City receiving bids in April sewage-disposal plant and 2400 sewer lines. Richards Engineering Co., 37½ East Long St., Columbus, Engr. Noted Mar. 8.

Ohio, Fremont—City plans improving sewers in Pine and Everett St. C. A. Hochenedel, City Engr.

Ohio, Hamilton—City made plans sewer in Hancock Ave. F. E. Weaver, City Engr.

Ohio, Mansfield—City plans 8-in. sanitary sewer in portion of Gibson Ave. W. J. Hazleton, City Engr.

Ind., Brazil—City soon receives bids sewerage system. Pearse & Greeley, 64 West Randolph St., Chicago, Engr.

Mich., Grand Rapids—Bd. Pub. Wks. soon receives new bids Southwest sewer system. About $160,000. W. S. Moore, City Engr.

Ill., Cambridge—(Official)—City receiving bids Apr. 10 disposal tank and 5600-ft. 12-in., 2620-ft. 10-in., 16,430-ft. 8-in., vitrified pipe in North East Dist. About $26,200. J. M. Pratt, Pres. Bd. Local Impvts. Noted Mar. 15.

Ill., Dixon—City receiving bids Apr. 1 sanitary sewer involving 4586 yd. earth or sand trenching 3050 ft. 8-in. pipe, 762 ft. 10-in., 2450 ft. 6-in., and 185 ft. 15-in. About $6000. C. F. Nesbit, Engr.

Ill., Early—City making plans sewer system. About $25,000. E. T. Archer Co., 512 New England Bldg., Kansas City, Mo., Engr.

Ill., Lombard—Village plans sewage plant and 12-mi. sewers. About $165,000. W. S. Shields, Hartford Bldg., Chicago, Engr.

Ill., Waukegan—See item under "Streets and Roads."

Wis., Mauston—See item under "Water-Works."

Wis., Oconomowoc—Bd. Pub. Wks. receiving bids Apr. 2 950 ft. 12-in., 300 ft. 10-in., 10 catch-basins, 12 manholes, 4400 ft. 8-in. sewer, 5 flush tanks, 2800 ft. water mains. A. Stemper, City Engr.

Ia., Clarion—City voted $65,000 installing storm sewers.

Ia., Davenport—(Official)—City receiving bids Apr. 3, 4 sewer jobs, involving about 4 mi. 8-, 10-, 12- and 15-in. pipe. About $20,900. F. W. Freidholdt, Clk. Bd. Pub. Wks. Noted Mar. 8.

Ia., Murray—City plans sewer system and water-works. About $40,000. E. T. Archer & Co., 514 New England Bldg., Kansas City, Mo., Arch.

Ia., Sioux City—(Official)—City receives bids about Apr. 9 sewage pumping plant. T. H. Johnson, City Engr. Noted Mar. 15.

Ia., Waterloo—City soon receives bids sewers in 25 streets. C. T. Wilson, City Engr. Noted Mar. 8.

Ia., West Branch—(Official)—City receiving bids in about 1 month for 2½ mi. sewers with sewage lift and filter bed. M. Tschirgi & Sons, 702 American Trust Bldg., Cedar Rapids, Engr. Noted Mar. 8.

Ia., Wilton Junction—City retained D. G. Fisher & Co., Engrs., Davenport, to make plans sewer system. About $30,000.

Minn., Atwater—City voted $24,000 bonds to install sewers. C. A. Swenson, City Clk.

Minn., Caledonia—City retained J. F. Druar, Consult. Engr., 312-316 Commercial Bldg., St. Paul, to make plans sewer system, street surface drainage and grades of sidewalks and streets. About $30,000 for sewer system.

Minn., Luverne—(Official)—City receiving bids about June 1 digging and laying 25 blocks sewer. About $5000. D. C. Campbell, City Recdr. Noted Mar. 15.

Kan., Hutchinson—City plans sewers in 3 streets. G. L. McLane, City Engr.

Sewers (Continued)

Kan., Pittsburgh—City soon lets contract laying 2100 ft. 8-in. lateral sewers. L. E. Curfman, City Engr.

Kan., Salina—City plans extending outfall sewer to lower point on Smoky Hill River. About $15,000 or $20,000. P. G. Wakenhut, City Engr.

Neb., Omaha—City receiving bids Apr. 10, combined storm and sanitary sewers. About $600,000. J. A. Bruce, City Engr.

S. D., Clear Lake—City will sell $25,000 bonds on Apr. 2 for sewers. T. L. Vought, City Audr.

N. D., Cooperstown—T. R. Atkinson, Bismarck, made plans sewer and water system. About $40,000.

Mont., Great Falls—City plans installing sewers. About $27,758. L. B. Evenson, City Engr.

Mont., Terry—Town receiving bids Apr. 3 trunk sewer. I. E. Thomas, Town Clk. Noted Feb. 22.

Mo., Joplin—City plans North Joplin No. 3 Sewer Dist. and Picher Ave. No. 1 Sewer Dist. J. J. McAffee, City Engr.

Mo., Milan—City receiving bids Apr. 10, sanitary sewers in Dist 1, 2 and 3, involving 31,428-ft. trenching and backfilling, 31,668-ft. of 8- to 10-in. sewer pipe, manholes, etc. E. T. Archer & Co., Engr.

Tex., Austin—City made plans sewage disposal plant. About $200,000. Hering & Gregory, 170 Broadway, New York Engr.

Okla., Bixby—City plans election to vote on $20,000 bonds to install sewers.

Okla., Frederick—City voted $30,000 bonds to install sewers.

Okla., Oklahoma City—City made plans intercepting sewer. About $200,000. H. A. Pressey, Dir. Engr. G. V. McClure, City Engr.

Okla., Okmulgee—See item under "Water-Works."

Colo., Pueblo—City plans storm sewer district in southern section of city. About $435,000. D. P. Saymon, City Engr.

Utah, Ogden—City plans election to vote on $200,000 bonds to install 3rd Ward Sewer. J. M. Tracy, City Engr.

Ariz., Flagstaff—City receives bids in May sewerage system involving 18,000 ft. 6-in., 8-in. and 12-in. pipe. About $38,000. C. M. Brooks, Engr. Noted Mar. 8.

Calif., San Diego—City made plans and bids will soon be received for Ocean Beach sewer system. Olmstead & Gillelen, Consult. Engr., Hollingsworth Bldg., Los Angeles, Engr. Noted Aug. 31.

Ont., Ford—(Official)—City receiving bids in May sewer system and sedimentation plant. O. McKay, Walkerville, Consult. Engr. About $60,000. Noted Mar. 8.

Ont., Smith Falls—Town Council plans sewer in Union St. About $6000. S. B. Code, Engr.

Bids In and Contracts Awarded

N. Y., New York—(Manhattan)—(Official)—M. M. Marks, Boro. Pres., Municipal Bldg., received low bids (a) laying sewers and appurtenances in portion 1st Ave. and outlet sewers in portions 96th and 102nd St. (b) alteration and improvement to sewer in portion 12th St., from J. Pillington, 3377 Sedgwick Ave., Bronx, (a) $181,564; U. S. Drainage and Irrigation Co., 17 Battery Pl., (b) $35,225; J. O'Leary, 411 East 42nd St.; (a) $188,611; Melrose Construction Co., 147 East 125th St., (a) $$196,873, (b) $36,345; T. A. Riley, (b) $36,524.

Va., Galax—City let contract sewer system to R. L. PLEVINS, Bristol. Noted Mar. 22.

Tenn., Erwin—(Official)—City let contract storm sewers to MURRAY CONSTRUCTION CO., Knoxville, $45,000. Noted Mar. 15.

Ohio, Amherst—City received low bids Martin-Milan Sanitary Sewer from Rose & Morse, $7800.

Ohio, Athens—Dept. Pub. Ser. will install by day labor 750 lin.ft. 6-in. sewer pipe in Hudson Ave. and 1400 lin.ft. 6-in. sewer pipe in East Union and Stewart St. F. Scott, Dir.

Wis., Chilton—City let contract sanitary sewers to HALLET & KIEHN, Antigo, $34,049.

Wis., Manitowoc—City received low bid storm and domestic sewers from GRAY-ROBINSON CO., $5448.

Wis., Sheboygan—(Official)—Bd. Pub. Wks. received low bids sewer system from E. Alday, Jr., $51,242, Central Construction Co., $53,244, F. E. Kaminski, $56,618. Noted Mar. 15.

Ia., Dunlap—Town let contract sewer system to M. A. CAMERY, Harlan, $30,722. Noted Mar. 22.

Minn., St. Cloud—City let contract storm sewer to E. L. GEDNEY, 610 Globe Bldg., Minneapolis.

Minn., St. Paul—City let contract sewer on Branston Ave. in St. Anthony Park N., to J. J. CONNELLY, $4386. Noted Mar. 1.

Minn., St. Paul—City let contract sewer in portion Middleton Ave. to DE GRAF-WOLFF, $5915.

Minn., West Minneapolis—City received low bids sewer system, disposal tank and outlet sewers (a) Proposition No. 1, total bid, (b) Proposition No. 2, general and lateral sewers, (c) Proposition No. 3, general sewer, (a) Proposition No. 4, disposal tank, from W. Danforth, 563 Laurel Ave., St. Paul, (a) $36,500, (b) $33,500; W. D. Lovell, 1415 South East 8th St., Minneapolis, (c) $3007; J. F. Albrecht, Glencoe, (d) $2675; E. L. Gedney, 2420 Colfax Ave., S., Minneapolis, (b) $33,982, (c) $2432; E. T. Sykes, 2317 Pleasant Ave., Minneapolis, (d) $3232; Republic Co., Albert Lea, (a) $38,570; Illstrup & Olson, Minneapolis, (a) $37,500, (b) $34,300, (c) $2710, (d) $3250.

Mo., Kansas City—See item under "Streets and Roads."

Tex., Big Springs—(Official)—City let contract sewer system and disposal plant to WINSLETT-ELDRIDGE CO., Dallas, $25,000. Noted Feb. 15.

GARBAGE

Proposed Work

N. J., East Orange—Council receiving bids Apr. 9, maintenance of garbage disposal and scavenger system in city for period of 1, 2, 3, 4 and 5 years. L. E. Rowley, City Clk. Noted Sept. 14.

Ala., Anniston—City plans garbage disposal plant. W. O. Ward, City Clk.

Ohio, Springfield—City soon receives bids garbage disposal plant. C. E. Ashburner, City Engr. Noted Feb. 3, 1916.

Man., Winnipeg—(Official)—Secy., Bd. Control, City Hall, receiving bids Apr. 16, 150-ft. chimney at garbage incinerators, Elgin and Elmwood Ave. W. P. Brereton, City Engr. Noted Feb. 8.

B. C., South Vancouver—(Official)—Municipality does not plan new system of garbage collection as stated in our issue of Mar. 8.

STREETS AND ROADS

Proposed Work

Vt., Newport—City receiving bids Apr. 16 paving 9500 sq.yd. concrete, 4000 ft. concrete curb and 3500 sq.yd. concrete sidewalks.

N. Y., New York—(Brooklyn)—L. H. Pounds, Boro. Pres., Room No. 2, Boro. Hall, receiving bids Apr. 4 regulating and repaving with Grade 1, granite pavement and 6-in. concrete foundation, Degraw, Fulton, Vanderbilt and Washington Ave. and Russell St.; permanent asphalt pavement on 8-in. concrete, Greene Ave.; on 6-in. foundation, Throop, 3rd and Vanderbilt Ave. and Warren St.

N. Y., New York—(Manhattan)—M. M. Marks, Boro. Pres., Room 2032 Municipal Bldg., receiving bids Apr. 5 regulating and repaving with sheet asphalt on stone block foundations portions of Broadway, 31st, 125th, 138th St. and 5th and Ave. D.

N. Y., Oswego—Dept. Works receiving bids Apr. 3, 5800 sq.yd. vitrified brick pavement on concrete foundation, 3100 sq.yd. 4-in. granite block pavement in double-track railroad area on concrete foundation, with catch basins, vitrified pipe connections, etc. J. F. Flanigan, City Engr.

N. J., Collingswood—(Camden post office)—City plans election to vote on $121,000 bonds to repave streets.

N. J., Freehold—Bd. Freeholders Monmouth County plans paving A. Belmar and 1st St. Address County Clk., Freehold.

N. J., Port Murray—Township Com. received no bids Hackettstown-Rockport Rd. Mansfield Township, Warren County. About 10,641 sq.yd. slag surface pavement. S. H. Perry, Township Clk. Noted Feb. 22.

N. J., South Amboy—Council plans paving portion David St., asphalt.

N. J., Trenton—City plans paving Central Ave., wood block on concrete base; Rockland Terrace, brick; Vail and Valley St., asphalt on concrete base. A. Swan, Jr., City Engr.

N. J., Trenton—Bd. Freeholders Mercer County plans paving Old York Rd. Address County Clk., Trenton.

N. J., Trenton—Bd. Freeholders Mercer County approved plans paving Sect. 3 River Rd., bituminous concrete, macadam base. A. Harris, Trenton, County Engr.

Pa., Catasauqua—Council plans paving 12 streets. About $6000.

Pa., Clearfield—Dept. Highways Clearfield County receiving bids Apr. 15 paving 2½ mi. of roads. A. E. Leitzinger, Clearfield, Supt.

Pa., East Mauch Chunk—(Official)—Boro. receiving bids in April or May paving 1852-ft. Center St., ameisite, tarvia, bituminous macadam or asphalt. About $12,000 to $15,000. Noted Mar. 15.

Pa., Warren—Warren County plans $300,000 bond issue to improve roads. Address County Clk., Warren.

Va., Portsmouth—Norfolk County Com. Roads and Bridges, care of R. B. Preston, Engr., Room 401, Commercial Bldg., receiving bids Apr. 2 building portion Cottage Line Road and Ocean View Blvd.

W. Va., Buckhannon—Upshur County, Buckhannon Dist., voted $180,000 bonds to build roads. E. Phillips, Buckhannon, County Clk. Noted Feb. 8.

W. Va., Ceredo—City receiving bids in 1 mi. pavement, brick on concrete base.

W. Va., Charleston—Lincoln County plan tion in April to vote on $650,000 bonds t highways in 8 districts. Address County Charleston.

W. Va., Fairmount—Marion County, Paw Dist., receiving bids Apr. 25 improving roads. About $330,000. Address County Fairmount. Noted Jan. 11.

W. Va., Fairmount—Marion County, L Dist., receiving bids Apr. 27 building 30 mi. A. G. Martin, Fairmount, County Clk. Mar. 15.

W. Va., Ronceberte—(Official)—Green County, Ft. Spring Dist., receiving bids May 1 18 mi. permanent road work. W Dougher, Engr. in Charge.

W. Va., Weston—Lewis County receiving bids Apr. 6 grading 2840 ft. Weston and Be Turnpike, 3585 ft. Weston and Gauley Br Turnpike, 3520 ft. Staunton and Parkersb Turnpike 2740 ft. Weston and Clarksburg Turnpike. L. Troxel, Weston, County Clk.

N. C., Hamlet—Bd. Comrs., City Hall, receiving bids Apr. 3, 50,000 lin.ft. concrete curb and gutter, 25,000 sq.yd. sidewalks, 20,000 cu.yd. grading and necessary drainage. L. R. Terry, Clk.

N. C., Marion—City plans to issue $40,000 bonds to pave streets. R. L. Greenlee, Engr.

N. C., Yadkinville—Yadkin County receiving bids Apr. 3 road from Donnaha to road near Jonesville, also from Crutchfield to Courtney. E. C. Mayberry, Yadkinville, County Clk.

S. C., Beaufort—City voted bonds to improve streets, concrete. H. G. Otis, City Engr.

Ga., Montezuma—City plans paving 5-mi. streets.

Ga., Statesboro—(Official)—City will sell, Apr. 2, $30,000 bonds to pave streets and $30,000 bonds to improve electric-light and water-works system. L. W. Armstrong, City Clk. Noted Feb. 22.

Ga., Tallapoosa—City plans hard surfacing streets, stone or slag.

Ga., Thomasville—(Official)—City election Apr. 27, to vote on bonds for paving streets. Noted Mar. 15.

Fla., Ocala—Marion County, Lake Hamilton Road and Bridge Dist., voted $90,000 bonds to build roads and bridges. Address County Clk., Ocala.

Fla., Quincy—City soon receives bids paving streets. About $50,000 to $75,000. J. B. McCrary Co., Atlanta, Engr.

Ala., Attalla—City election Apr. 12 to vote on $11,000 bonds, part of proceeds to be used for paving streets.

Ala., Birmingham—City plans paving portion 5th Ave. asphalt. J. Kendrick, City Engr.

Ala., Gadsden—Etowah County plans rebuilding Hoke's Bluff Rd. About $26,000. Address County Clk., Gadsden.

Miss., Columbus—Lowndes County, Artesia Road Dist., plans to vote on $25,000 bonds to improve roads. Address County Clk., Columbus.

Miss., Hattiesburg—Bd. Supervs. Forest County receiving bids May 7 paving 50-mi. gravel road. R. M. Hendrix, Hattiesburg, Pres. Noted Mar. 1.

Miss., Indianola—Sunflower County sold $200,000 bonds to improve gravel roads in Dist. 2 and 3. Address County Clk., Indianola. Noted Mar. 8.

Miss., Yazoo City—Yazoo County plans to spend $132,000 for building roads. Address County Clk., Yazoo.

La., Colfax—Grant Parish, Road Dist. No. 8, voted $150,000 bonds to build 33-mi. Jefferson Highway. Address Police Jury, Colfax. Noted Dec. 28.

Tenn., Athens—McMinn County plans to vote on $300,000 bonds to build roads. Address County Clk., Athens.

Tenn., Jackson—Washington County voted $75,000 bonds to build roads. Address County Clk., Jackson.

Tenn., Jonesville—Washington County voted $750,000 bonds to build highways. Address County Clk., Jonesboro. Noted Feb. 22.

Ky., Hazards—(Official)—Perry County to vote Apr. 14 on $150,000 bonds to build roads. B. P. Combs, Hazards, County Clk. Noted Mar. 15.

Ky., Hindman—Knott County receiving bids Apr. 24, 3-mi. roadway on Troublesome Creek. Address County Clk., Hindman.

Ky., Pikeville—Pike County receiving bids Apr. 25, 5-mi. highways. Address County Clk., Pikeville.

Ky., Prestonsburg—Floyd County receiving bids Apr. 25, 6-mi. road from Prestonsburg to Beaver Creek. Address County Clk., Prestonsburg.

Ohio, Bellefonte—(Official)—City receiving bids about June 1, paving Stanton Ave., brick. About $22,000. C. A. Inskeep, City Engr.

Ohio, Canton—City plans improving portion 14th St., N.W. W. E. Sarver, City Engr.

Ohio, Canton—City plans paving Beldon and Webster Ave. W. E. Sarver, City Engr.

Ohio, Cincinnati—Hamilton County made plans resurfacing various roads, asphalt. About $81,620 W. H. Boeh, Cincinnati, County Engr.

Streets and Roads (Continued)

Ohio, Cincinnati—Hamilton County plans to spend $160,598 to improve roads, $50,000 to be spent on new concrete roads. Address County Clk., Cincinnati.

Ohio, Circleville—City receiving bids about June 1 paving 18,756 sq.yd. Franklin St., brick, on 6-in. concrete base. H. F. Alkire, City Engr.

Ohio, Cleveland—City plans paving portion Conover, East 69th, West 91st, and Roehl St. R. Hoffman, City Engr.

Ohio, Cleveland—City plans to issue $1,026,000 bonds to pave streets. R. Hoffman, City Engr.

Ohio, Columbus—C. A. Borden, Dir. Pub. Ser., receiving bids Apr. 13 grading, curbing, draining and paving roadway, asphalt or brick and laying water surface pipe on 5th, Pace and Welch Ave. and Lafayette St.

Ohio, Dover—Town to sell $30,000 bonds Apr. 17, to improve and pave roads and highways.

Ohio, Ironton—City plans paving sidewalks, concrete. L. G. Howell, City Engr.

Ohio, Lima—Allen County plans paving 5-mi. roads. Address County Clk., Lima.

Ohio, Marion—City plans improving portion Carner Ave. E. S. Rult, City Engr.

Ohio, Mt. Gilead—(Official)—Morrow County Comrs. receiving bids Apr. 6 5.87 mi. Mt. Gilead-Iberia Rd., concrete or monolithic brick; 3.66 mi. Mt. Gilead-Waterford Rd., concrete, and 4.57 mi. Penlan Rd., dry macadam. G. F. Clements, Mt. Gilead, County Surv. Noted Feb. 22.

Ohio, Wooster—Wayne County made surveys paving roads during year. A. Randall, Wooster, County Surv.

Ohio, Yellow Springs—City plans paving 3 mi. streets, macadam. J. P. Shumaker, Xenia, Engr.

Ohio, Youngstown—City plans to issue $32,000 bonds to improve streets. F. M. Lillie, City Engr.

Ind., Albion—Noble County receiving bids Apr. 3, paving 12-mi. brick roads in Perry and Sparta Townships. About $180,000. Address County Clk., Albion.

Ind., Bedford—Lawrence County receiving bids Apr. 3, 3 roads Marion Township, 1 in Bono Township, 4590, 7484, 2787 and 4345 ft. respectively, gravel or macadam. E. W. Edwards, Bedford, County Audr.

Ind., Bloomfield—Greene County receiving bids Apr. 3 2 macadam roads, Wright Township. G. E. Kidd, Bloomfield, County Audr.

Ind., Bluffton—Wells County receiving bids Apr. 4 12,341 ft. stone streets in Bluffton, 5331 ft. stone road Jefferson Township, 1319 ft. concrete streets in Unondale, 5100 ft. stone road Lancaster Township, 6450 ft. stone road Lancaster Township, 4843 ft. stone road Chester Township. T. Kain, Bluffton, County Audr.

Ind., Columbia City—Whitley County receiving bids Apr. 4 gravel road. T. A. McLaughlin, Columbia City, County Audr.

Ind., Frankfort—Clinton County receiving bids in April graveling 5676 ft. Lewis-Galloway Rd., Owen Township. G. D. Brewer, Frankfort, County Engr.

Ind., Greensburg—Decatur County receiving bids Apr. 2 roads in Washington, Clinton, Clay and Sandcreek Townships. J. C. Barbe, Greensburg, County Audr.

Ind., Indianapolis—City plans resurfacing portion South St. B. J. T. Jeup, City Engr.

Ind., Indianapolis—City plans paving various streets. About $100,000. B. J. Jeup, City Engr.

Ind., Jasper—Dubois County receiving bids Apr. 14 road Patoka Township. J. H. Seng, Jasper, County Audr.

Ind., Knoxville—Starke County Comrs. receiving bids Apr. 3 improving road in Oregon Township. C. W. Weninger, Knox, County Audr.

Ind., Kokomo—Howard County receiving bids Apr. 3, 3968 ft. stone road Clay Township. W. L. Benson, Kokomo, County Audr.

Ind., Logansport—(Official)—Cass County receiving bids Apr. 3, improving highways. A. P. Flynn, Logansport, County Audr.

Ind., New Albany—City soon receives bids improving portion Market St., concrete. S. T. Mann, City Engr.

Ind., Newcastle—Henry County receiving bids Apr. 2 gravel road Wayne Township. J. O. Holtsclaw, Newcastle, County Audr.

Ind., Plymouth—Marshall County receiving bids Apr. 3 4 gravel roads in Polk Township and 2 in Center Township. O. H. Weber, Plymouth, County Audr.

Ind., Rushville—Rush County receiving bids Apr. 2, 10,672 ft. gravel road on line of Ripley and Posey Townships. W. H. McMillan, Rushville, County Audr.

Ind., Terre Haute—(Official)—Bd. Pub. Wks. receiving bids Apr. 7, paving 1½-mi. South 3rd St., monolithic brick. F. A. Rattman, City Engr. Noted Mar. 8.

Mich., Boyne City—City voted $25,000 to build roads.

Mich., Carson City—Montcalm County, Bloome Township, election Apr. 2 to vote on $50,000 bonds to build roads. Address County Clk., Stanton.

Mich., Ithaca—Gratoit County, North Shade Township, election Apr. 2 to vote on $60,000 bonds to build roads. Address County Clk., Ithaca.

Mich., Marquette—City plans paving 25,000 sq.yd., macadam. M. H. Wright, City Engr.

Mich., Wyandotte—City plans to improve portions Forest, Spruce, Plum, Cherry, Cedar and Orchard St. G. Jerome, City Engr.

Ill., Bloomington—City made plans paving portion South Main St., 16,159 sq.yd. brick, 1414 ft. sandstone curb. G. Packard, Engr., care of E. Jones, Mayor.

Ill., East Moline—City plans paving 3rd St., concrete. About $16,490.

Ill., Gibson—City making plans paving portion West 8th St., brick on concrete base. About $8529. L. W. Lemon, Clinton, Engr.

Ill., Newman—Douglas County plans to build 2-mi. state aid roads during year. Address County Clk., Tuscola.

Ill., Ottawa—La Salle County, Allen Township, voted $18,000 bonds to build roads. Address County Clk., Ottawa.

Ill., Pontiac—City making plans paving various streets, brick on concrete base. J. C. Wade, Sterry Blk., Engr.

Ill., Quincy—Adams County soon lets contract 2-mi. roads. About $26,000. State to appropriate $13,000 and County $13,000. Address County Clk., Quincy.

Ill., Waukegan—(Official)—Bd. Local Impvts. receiving bids Apr. 2 paving various streets, $70,000; also installing sewers, $5100. M. J. Douthitt, City Engr.

Wis., Balsam Lake—Polk County plans to vote on $400,000 bonds to build roads. Address County Clk., Balsam Lake.

Wis., De Pere—City plans paving Lewis, Merrill and Grant St. and Main and 8th Ave. C. W. Muller, City Clk.

Wis., Ft. Atkinson—City making plans paving 25,000 sq.yd., Whitewater and Milwaukee Ave., Madison, Grant and Water St. E. B. Parsons, Jefferson, Engr.

Wis., La Crosse—City receiving bids Apr. 10 paving 10 streets, brick. W. J. Fries, City Clk.

Ia., Cedar Falls—City making plans paving 25 blocks, asphalt or asphaltic concrete. C. H. Streeter, City Engr.

Ia., Cedar Rapids—City soon receives bids paving 5000 sq.yd. alleys, cement concrete. T. F. McCauley, City Engr.

Ia., Clarion—Wright County plans grading and graveling roads. About $40,000. E. G. Krull, Clarion, County Engr.

Ia., Davenport—City plans paving streets. About $250,000. A. R. Boudinot, City Engr.

Ia., Dubuque—City plans paving 50,000 sq.yd. creosoted wood blocks, 25,000 sq.yd. macadam, 25,000 sq.yd. bitulithic and 5000 sq.yd. brick. F. J. McNulty, City Engr.

Ia., Glenwood—City retained T. S. De Lay, Engr., Creston, to make plans 35,000 sq.yd. paving 24-ft. roadway, 30,000 ft. curb and gutter.

Ia., Orange City—(Official)—Town receiving bids Apr. 6 paving portion Main St. About $35,000. F. J. Lohr, Town Clk. Noted Mar. 8.

Ia., Sioux City—Woodbury County receiving bids Apr. 3 grading 125,000 cu.yd., 1 underground and 1 grade railroad crossing. J. C. McLean, Sioux City, County Engr.

Ia., Sioux City—County receiving bids Apr. 3 12 mi. permanent roads, 140,000 cu.yd. excavation. J. C. McLean, Sioux City, County Engr.

Ia., Sioux City—(Official)—City receiving bids Apr. 21, paving 20,000 yd. concrete. T. H. Johnson, City Engr.

Ia., Sioux City—City plans to spend $350,000 paving streets during year. T. H. Johnson, City Engr.

Ia., Storm Lake—Buena Vista County receiving bids Apr. 3, graveling 56-mi. roads. G. K. McCollough, Storm Lake, County Engr.

Minn., Buffalo—Wright County receiving bids Apr. 10 graveling and grading State Rds. Nos. 2, 3, 5 and 6. J. A. Borg, Buffalo, County Audr.

Minn., Caledonia—See item under "Sewers."

Minn., Park Rapids—Hubbard County soon receives bids improving 10 mi. roads. About $14,015. C. E. Spencer, Park Rapids, Highway Engr.

Minn., Pine City—Pine County Royalton Township, making plans roads and bridge work. W. H. Hamline, Pine City, County Audr.

Minn., Redwood Falls—(Official)—Redwood County receiving bids Apr. 10 grading State Rd. No. 12, graveling State Rural Highway No. 50 and portion State Rd. No. 9 and State Rural Highway No. 93. L. P. Larson, Redwood Falls, County Audr.

Minn., St. Cloud—City lets contract in summer paving 25,000 sq.yd. bitulithic. C. H. West, City Engr.

Minn., St. Paul—H. W. Austin, Pur. Agt., City Hall, receiving bids Apr. 2 grading portions of Palace, Norton, Carroll and Etna St. and Payne Ave.

Minn., St. Peter—Nicollet County receiving bids Apr. 3 grading 5 mi. county roads and building culverts. W. H. Holz, County Audr.

Kan., Augusta—City soon receives bids sheet asphalt and brick paving. About $20,000. Black & Veatch, Interstate Bldg., Kansas City Mo., Engr.

Kan., Independence—City plans paving portion Bungalow St. G. E. Weaver, City Engr.

Kan., Larned—City plans paving 50 blocks.

Kan., Parsons—City receiving bids Apr. 16, 25,000 yd. paving, brick, concrete and asphaltic concrete. F. W. Frye, City Clk.

Kan., Tribune—Greeley County plans grading 20 mi. roads. C. Barnes, Tribune, County Clk.

Neb., Schuyler—Colfax County making plans improving roads and building drainage ditch. About $25,000. E. H. Vrana, Engr.

S. D., Mitchell—City plans improving West 1st Ave. S. H. Smith, City Engr.

N. D., Bismarck—Burleigh County plans improving roads. T. Flaherty, Bismarck, County Audr.

N. D., Jamestown—City receiving bids Apr. 2 cement sidewalks during 1917. C. E. McElroy, City Audr.

N. D., Kenmare—City receiving bids Apr. 2, building sidewalks during year. E. Griffith, City Audr.

N. D., Williston—Williams County plans improving roads. About $10,000. M. T. Aan, Williston, County Audr.

Mont., Helena—Lewis and Clark County plan building roads. About $15,000. Address County Clk., Helena.

Mont., Livingston—Parke County Comrs. plan road between Carbella and Corwin. C. A. Burg, Livingston, County Clk.

Mont., Shelby—Toole County plans building 2 roads. H. E. Moody, Shelby, County Clk.

Mo., Benton—Scott County plans building highways. About $950,000. Address County Clk., Benton.

Mo., Brunswick—City soon receives bids paving 10,000 sq.yd. streets. Tuttle, Ayres & Woodard, 307 Reliance Bldg., Kansas City, Arch.

Mo., Greenville—Wayne County to sell $200,000 bonds to build roads. Address County Clk., Greenville.

Mo., Kansas City—(Official)—Bd. Pub. Wks. making plans paving portion Beardsley St. south of 12th St. About $100,000. C. Hill, City Engr.

Mo., Rock Port—Atchison County, Tarkio Special Road Dist., plans to vote on $50,000 bonds to improve roads. Address County Clk., Rock Port.

Mo., Sedalia—Council plans to pave portion of 2nd St. F. T. Leaming, City Engr.

Ark., Jasper—Newton County plans 21 mi. road between Jasper and Harrison. P. H. Sutton, Jasper, County Surv.

Tex., Abilene—Taylor County plans to vote on $100,000 bonds to build roads. Address County Clk., Abilene.

Tex., Boston—Bowie County Comrs. plan to build 10-mi. road along state line from Texarkana to Red River near Index. Address County Clk., Boston.

Tex., Dallas—(Official)—Dallas County sold $500,000 bonds to improve roads, bridges and culverts. C. E. Gross, Dallas, County Audr. Noted Mar. 8.

Tex., Dallas—City plans paving portion Dawson St. H. Moseley, City Engr.

Tex., Georgetown—Williamson County, Precinct No. 4, election Apr. 17, to vote on $500,000 bonds to build roads. Address County Clk., Georgetown. Noted Feb. 1.

Tex., Hamilton—City voted $20,000 bonds to improve streets. Noted Mar. 8.

Tex., Paris—Lamar County election Apr. 28, to vote on $1,000,000 bonds to build roads. Address County Clk., Paris.

Tex., Snyder—Scurry County election Apr. 7 to vote on special tax levy to build roads. Address County Clk., Snyder.

Okla., Durant—City plans paving 35,000 sq.yd. during year.

Okla., Norman—Cleveland County, Norman Township, plans to vote on $30,000 bonds to build roads. Address County Clk., Norman.

Okla., Okemah—Okfuskee County, Okemah, Castel and Lincoln Townships, voted $40,000, $20,000 and $10,000 bonds respectively, to build portions Ozark Trail. Address County Clk., Okemah.

Okla., Pauls Valley—Garvin County plans $250,000 bond issue to build roads and bridges. N. J. Harris, Pauls Valley, County Clk.

Okla., Sapulpa—City plans paving portion Bryan St. R. N. Whittlesey, City Engr.

N. M., Lincoln—Lincoln County voted $55,000 bonds to build roads. Address County Clk., Lincoln.

Idaho, Idaho Falls—Bonneville County election in May to vote on $200,000 bonds to build roads. Address County Clk., Idaho Falls.

Idaho, Sandpoint—Bonner County plans building 15 mi. road and surfacing 10 mi. with gravel. R. S. McCrea, Sandpoint, County Clk.

Utah, Ogden—City making plans paving 14 blocks, Dist. No. 125, 3-in. asphalt binder on 6-in. concrete base. J. M. Tracey, City Engr.

Utah, Provo—Utah County election Apr. 17 to vote on $750,000 bonds paving roads. Address County Clk., Provo.

Ariz., Flagstaff—(Official)—City receiving bids about May 1, paving 23 blocks, bitulithic, 4-in. concrete base, 3½ blocks, concrete. About $90,000. C. M. Brooks, City Engr.

Streets and Roads (Continued)

Ariz., Florence—Pinal County election Apr. 14 to vote on $150,000 bonds to build roads and bridges. Address County Clk., Florence.

Ariz., Yuma—City lets contract in April paving portions 1st St. and 2d Ave., bitulithic, concrete or asphalt. Noted Dec. 7.

Wash., Centralia—City plans laying 62,000 lin.ft. concrete sidewalks, 5 ft. wide. R. S. Welch, City Engr.

Wash., Chehalis—Lewis County plans 4-mi. hard surface roads. Address County Clk., Chehalis.

Wash., LaConner—City plans paving portion Center St., 7-in. 1 course concrete, also 2d, 3d, 4th, 5th and 6th St. About $10,000.

Wash., Wenatchee—Chelan County plans paving 1¼ mi. near Monitor bridge, 1 course concrete, $12,000, grading $6,000. T. L. Ross, Wenatchee, County Audr.

Calif., Needles—City plans to pave streets in business district and build sidewalks and curbs in residence districts.. K. F. Tuttle, City Engr.

Calif., Seal Beach—J. MacMillan, City Clk., receiving bids Apr. 12 paving portion Main St. and Ocean Ave., 4-in. concrete base, oil top.

Calif., Visalia—Tulare County voted $2,200,000 bonds to build 223 mi. paved highways. Address County Clk., Visalia. Noted Feb. 8.

Que., Mt. Johnson—Town council plans 7-mi. sidewalks.

Ont., Sarnia—City plans paving London Rd., cement. J. A. Baird, City Engr.

Bids In and Contracts Awarded

N. Y., Albany—(Official)—State Comr. of Highways, 55 Lancaster St., received bids Mar. 20, bituminous materials, Contract No. 6, all divisions, material "A," L. H. O., from Atlantic Refining Co., $37,851, Standard Oil Co., $39,119, Barber Asphalt Co., $46,274; Contract No. 7, all divisions, material "T," cold application, Barrett Co., $38,682, United Gas and Improvement Co., $39,348; Contract No. 8, Division Nos. 3, 5, 6, 7, 8 and 9, cold patch, asphaltic emulsion, Atlantic Refining Co., $51,173, Capitol City Supply and Contracting Corp., $54,336, Headley Good Roads Co., $54,488. Noted Mar. 8.

N. Y., Albany—(Official)—State Comr. of Highways, 55 Lancaster St., received bids Mar. 19, bituminous material, Contract No. 1, all divisions, binder "A," from Atlantic Refining Co., $44,089, Standard Oil Co., $45,952, Barber Asphalt Co., $69,106; Contract No. 2, all divisions, "A," L. C. O. Atlantic Refining Co., $12,083, Standard Oil Co., $12,200; Contract No. 3, all divisions, material "T," hot application and binder, Barrett Co., $5536; Contract No. 4, all divisions, material "T" cold application, Barrett Co., $31,346; Contract No. 5, Divisions 1, 2 and 4, cold patch, asphaltic emulsion, Atlantic Refining Co., $59,735, Headley Good Roads Co., $62,890 Capitol City Supply and Contracting Corp., $63,735. Noted Mar. 8.

N. Y., Buffalo—City let contract paving Littell Ave. to B. F. SPIRE, $8371.

N. Y., Buffalo—City let contract paving Moeller St. to H. P. BURGARD CO., 1968 Fillmore St., $8,330. Noted Aug. 10.

N. Y., Buffalo—City let contract paving Quincy and Peck St. and Warring Ave. to H. P. BURGARD CO., $9980, $16,750 and $10,500 respectively.

N. Y., New York—(Bronx)—(Official)—Dept. Parks, Municipal Bldg., received low bid repaving Pelham Bay Park Blvd. from Asphalt Construction Co., Madison Ave. and 137th St., Manhattan, $47,975. Noted Mar. 8.

N. Y., New York—(Brooklyn)—(Official)—Park Bd., Municipal Bldg., Manhattan, received low bids extending Eastern Parkway and paving intersections of Ocean Parkway from Ulvalde Asphalt Paving Co., $147,977 and $5562, respectively. Noted Mar. 8.

N. Y., New York—(Brooklyn)—(Official)—L. H. Pounds, Boro. Pres., Room 2, Boro. Hall, received low bids Mar. 21, improving portions (a) Humboldt St., (b) Myrtle Ave., (c) Neptune Ave., (d) Rush St., (e) Taylor St., (f) 9th St., (g) 68th St., as follows: Uvalde Asphalt Paving Co., Metropolitan Ave., (a) $15,885; M. J. O'Hara, 577 3rd St., (b) $14,235, (f) $18,016; Brooklyn Alcatraz Asphalt Co., 407 Hamilton Ave., (c) $24,194, (g) $8614; J. J. Towers, 102 Sunnyside Ave., (d) $5011, (e) $7158. Noted Mar. 15.

N. Y., New York—(Manhattan)—(Official)—M. M. Marks, Boro. Pres., Room 2032 Municipal Bldg., received low bids Mar. 26, (a) repaving portion 19th St., (b) 209th St., from Asphalt Construction Co., Madison Ave. and 137th St., (a) $16,313, and Burnside Contracting Co., 270 Burnside Ave., (b) $6094. Noted Mar. 22.

N. Y., New York—(Richmond)—(Official)—C. D. Van Name, Boro. Pres., Boro. Hall., St. George, New Brighton, received low bids Mar. 26, improving portion Castleton Ave., brick gutters and crosswalks and concrete curb with steel guard from Cramer & Leedke, 114 East 52nd St., Manhattan, $6567; J. Johnson's Sons, $6728; J. E. Donovan, $6995. Noted Mar. 22.

N. Y., Watervliet—(Official)—City let contract paving 3rd Ave., 9th St. and Broadway to T. F. O'SHAUGHUESSY, Albany, $172,815. Noted Feb. 22.

N. J., Belleville—Town let contract paving various streets to P. & P. JANARONE, 225 Passaic Ave., $8000.

N. J., Passaic—Dir. Dept. Streets and Pub. Impvts. let contract paving portion Grove St. to DYER KANE CO. Noted Jan. 4.

N. J., Turnersville—Bd. Freeholders Gloucester County let contract 4-mi. concrete road to W. STRAUB, Mamaroneck, N. Y., $97,211. Noted Mar. 15.

N. J., Westfield—Town let contract improving portion Hillcrest, Kimball and Union Ave. to WELDON CONTRACTING CO., $17,456. Noted Mar. 15.

Pa., Hollidaysburg—Blair and Bedford Counties let contract 13-mi. highways to J. S. VIPOND, Altoona.

Pa., New Castle—Lawrence County let contract grading and paving 6-mi. highway to SCHILLING CONSTRUCTION CO., Youngstown, $161,606. Noted Jan. 25.

Pa., Phila.—(Official)—Bureau of Highways, Dept. Pub. Wks., received low bids Mar. 16, street improvements, (a) Schedule A, asphalt paving, (b) Schedule B, asphalt repaving, (c) Schedule C, vitrified block repaving, (d) Schedule E, wood block repaving, (e) Schedule F, curb and footway work, (f) Schedule G, repairing bituminous pavements from Barber Asphalt Paving Co., Land Title Bldg., (a), (b), (d); Eastern Paving Co., Penn Sq. Bldg., (a), (b); Mack Paving and Construction Co., 20th and Sedgley Ave., (a); Philadelphia Paving Co., 1345 Arch St., (a), (b); Ryan & Reilly Co., 33rd and Grays Ferry Rd., (c), (d); D. J. Lynch, 4029 Cambridge St., (d); J. J. McHugh, 1430 South Penn Sq., (e); P. J. Snyder & Co., 176 E. Tulpehocken St., (f).

Pa., Phila.—City let contract grading portions 21st and Nedro St. to H. C. AMBLER, Phila., $7965; Columbia Ave. to T. J. REILLY., $6573.

Pa., Republic—Comrs. Redstone Township let contract grading streets to AUSTIN & MATHEWS.

Md., Baltimore—State Roads Com. let contract 3.07 mi. concrete road, Contract F-25, to POTOMAC ENGINEERING AND CONTRACTING CO., Baltimore, $55,460.

Md., Baltimore—State Roads Com. let contract road leading from Porter's Bridge to Rising Sun Contract Ce-9, E .W. BROWN, Port Deposit, $73,086. Noted Mar. 1.
Connellsville, $10,000.

W. Va., Clarksburg—Harrison County rejected bids paving 4-mi. road, Clay Dist. G. M. Harbery, Clarksburg, County Engr. Noted Feb. 22.

W. Va., Morgantown—(Official)—Monongalia County received low bids paving 6-mi. highway, Morgan Dist., (a) Kindwood Pike No. 3; (b) Sabraton-Dellslow Rd. No. 4; (c) Stewartstown Rd.; (d) Chestnut-Ridge Rd. No. 8; (e) Charles Ave. No. 10; (1) brick, (2) concrete, (3) macadam, from T. Pietro, (a) (1), $55,868, (a) (2) $50,743, (b) (1) $36,618, (b) (2) $28,841, (c) (1) $29,152, (c) (2) $23,551, (d) (3) $31,321, (d) (2) $29,642, (e) (1) $19,828, (e) (2) $16,356, (e) (3) $15,513; P. F. Rhodes & Son, McKeesport, Pa., (a) (1) $68,202, (a) (2) $60,122; Ridge Bros., 407 4th Ave., Pittsburgh, (a) (1) $60,075, (a) (2) $67,838, (b) (1) $39,494, (b) (2) $34,860; Hottell Construction Co., Pulaski, Va., (a) (2) $77,419. Noted Feb. 22.

N. C., Monroe—Bd. Aldermen let contract paving portion Main, Hayne, Church and 4 other streets, asphalt; also building sidewalks and gutters portion West Franklin, West Jefferson and Morris St. to GULF PAVING CO., Chattanooga. Noted Feb. 8.

N. C., Rocky Mount—City let contract bitulithic paving to R. G. LASSITER & CO., Oxford. Noted Mar. 1.

Ala., Florence—Lauderdale County let contract improving 2 mi. Jackson Highway to STANLEY-SPRINGER CONSTRUCTION CO., Lafayette; 3 mi. Florence and Waterloo Rd. to R. C. SMITH, Oakland.

Miss., Iuka—Tishomingo County let contract 6-mi. gravel road to F. D. HARVEY & CO., 688 South Bell Ave., Memphis, $11,727.

La., Houma—(Official)—Bd. Supervs. Terrebonne County let contract subgrade for road from corporation line to Bayou Grand Coteau, 4.6-mi. including 103,300 cu.yd. excavation to BRUMBAUGH & WHITINGER, New Orleans, 8c. per cu.yd. Noted Mar. 8.

Ky., Russellville—Logan County let contract ½-mi. road from Russellville to Lewisburg to F. C. CARROLL, Russellville, $35,000; 2½-mi. road from Russellville Franklin Pike to G. H. BYARS, $5000.

Ohio, Cincinnati—City let contract paving portion Vine St. to KIRCHNER CONSTRUCTION CO., 221 West 9th St., $32,586.

Ohio, Cleveland—City rejected bids paving portion East 110th St. R. Hoffman, City Engr.

Ohio, Dayton—(Official)—City let contract paving Oxford Ave. to W. J. REIMAN & CO., Cincinnati St., $11,600.

Ind., Bicknell—City let contract paving Alton and West 6th St., concrete, to S. LANE & A BOYD. Noted Dec. 28.

Ind., Bloomington—Monroe County let contract Steinhagen and Hanna Rd. to CAMPBELL & DOBSON.

Ind., Brazil—Clay County let contract Hadden Rd. to KEEGAN BROS.

Ind., Crawfordsville—Montgomery County rejected bids Grant McDowell Rd., Franklin Township. About $23,543. M. Ness, Crawfordsville, County Engr.

Ind., Greencastle—City let contract improving Bloomington St. to C. B. PARKER, Greencastle, $6700.

Ind., Huntington—Huntington County let contract Foulke Rd., Dallas Township, to S. PALMER, $4700.

Ind., Huntington—Huntington County let contract Smith Rd., Jackson Township, to M. GROWE, $15,642.

Ind., Huntington—Huntington County let contract Wildermuth Rd., Wayne Township and Lawrence Rd., Jefferson Township, to HUFFMAN BROS., $12,490 and $7671 respectively.

Ind., Lawrenceburg—(Official)—Dearborn County let contract road on Dearborn and Ripley county line to STEVENS & SHILLING, R.R. No. 1, Moores Hill, $6499. Noted Mar. 1.

Ind., Logansport—City let contract improving M. T. Didlike Rd. to H. M. BELL, Logansport, $32,600.

Ind., Princeton—Gibson County, let contract Buesing Rd., Johnson Township, to J. N. KINMAN, $17,751.

Ind., Princeton—Gibson County let contract Joseph Emerson Rd., Montgomery Township, to J. M. OWEN & SONS, Poseyville, $18,785.

Ind., Princeton—Gibson County, let contract Marshall Rd., Center Township to S. R. ADAMS & CO., Princeton, $10,254.

Ind., Princeton—Gibson County let contract Wirth Rd., Union Township, to J. N. KINMAN, $17,500.

Ind., Shelbyville—Shelby County let contract 1½ mi. highway to HARSHMAN & JARRELL, Frankfort, Ensminger Rd., Van Buren Township, $9220, Lowden Rd., Van Buren Township, $9174, Higgins Rd., Liberty Township, $6180; W. AVERY, Price Rd., Noble Township, $6190.

Mich., Kalmazoo—Kalamazoo County let contract West Territorial Rd. to BOYES & BLANDFORD CO., Commercial Bank Bldg., Grand Rapids.

Mich., St. Johns—City let contract paving portion Linden and Maple Ave., Case and Higham St. to MARSMAN & GREEN, Grand Rapids, $10,500.

Ill., Edwardsville—Madison County, Helvetia Township, let contract road to HUY LUMBER AND CONSTRUCTION CO., Highland, $11,870.

Ill., West Frankfort—Bd. Local Impvts. let contract paving to J. L. DORRIS, Harrisburg, $78,249.

Wis., Barksdale—Town let contract grading 8-mi. roads to PEPARD & FULTON, $36,000.

Wis., Merrill—Bd. Pub. Wks. rejected bids paving Mill and 1st St.

Wis., Oconomowoce—City let contract rein.-con. paving to NELSON & WEBER CO., Oconomowoce, $15,000.

Wis., Racine—(Official)—Bd. Pub. Wks. received low bids paving 12,000 sq.yd. Washington Ave. and 17,000 sq.yd. Michigan Blvd. from J. Cape Sons, $2.42 and $2.21 per sq.yd. respectively; 4400 sq.yd. Carlisle Ave. from Western Improvement Co., $2.12 per sq.yd. Noted Mar. 1.

Wis., Racine—(Official)—Racine County let contract paving portion Durand Ave. to J. R. GRIFFITH, Racine, $15,000.

Ia., Sac City—Sac County let contract grading 456,390 yd. to G. W. CONDON, Omaha, W. R. SHIPMAN, Sioux City, and T. CAREY & SON, Clinton.

Minn., Tracy—(Official)—City let contract paving streets to HANLON & OKES, Minneapolis, $47,545. Noted Mar. 8.

Kan., Minneapolis—(Official)—City let contract paving streets to KITCHIE BROS., Topeka, $53,000.

Neb., Omaha—City let contract paving West Center St. to J. A. BEEBE, 1714 Sagler St., $25,000.

Mont., Great Falls—City let contract paving portion Central Ave. to R. J. WHITE, $8096. Noted Oct. 15.

Mo., Kansas City—City let contract curbs, gutters and catch basins on both sides of Budd Park Esplanade to MISSOURI SIDEWALK CO., 210 Mass Bldg., Kansas City, 54c. per lin.ft.

Mo., Kansas City—City let contract 7080 sq.yd. concrete paving on Fuller St. to E. F. WILCOX CONTRACTING CO., Dwight Bldg., $10,266.

Mo., Kansas City—Park Bd. let contract grading and paving Brookside Blvd., to P. LORIMER, $20,500.

Mo., Kansas City—(Official)—Bd. Pub. Wks. let contract paving Beardsley St. north of 12th St. to LIST & WEATHERLY CONSTRUCTION CO., $37,140.

Streets and Roads (Continued)

Tex., Caldwell—Burleson County let contract improving roads to DAWSON & WOODWARD, San Antonio, $12,500. Noted Feb. 22.

Tex., Edna—Jackson County let contract building roads to DAVIS & KELLY, Francitas.

Okla., Oklahoma City—City let contract paving portion Broadway and 24th St. to CONLEY CONSTRUCTION CO., El Reno, $1.75 per yd.

Wash., Coupeville—(Official)—Island County let contract 3-mi. Permanent Highway No. 3 to GALBREATT BROS., Clinton, $4400. Noted Mar. 1.

Wash., Duval—King County let contract paving highway to ERICSON, ANDERSON & HICKER, 1002 North Ainsworth Ave., Tacoma, $24,918.

Calif., San Francisco—Bd. Pub. Wks. let contract improving portions Judah St. to A. E. BUCKMAN, 352 Geary St., $14,843; 33d Ave., O. McHUGH, Russ Bldg., $7228; 33d Ave., P. McHUGH, 3908 Clay St., $5184; Granada Ave., BLANCHARD-BROWN CO., 660 Market St., $5167; 42d Ave., FEDERAL CONSTRUCTION CO., Sharon Bldg., $5858 and $5104 (2 portions).

Calif., San Francisco—Bd. Pub. Wks. let contract improving portion Railroad Ave. to J. H. SMITH, Monadnock Bldg., $47,219.

Que., Notre Dame du Mont Carmel—City let contract cement sidewalks to LAURIN & DAIGNEAULT, Napierville, $5000.

INDUSTRIAL WORK

Proposed Work

Mass., Fall River—Fall River Bleachery plans 1-story 80 x 200-ft. addition. J. A. Stevens, Lowell, Engr., soon receives bids.

Mass., Franklin—Clark, Cutler & Medermott Co. made plans additions to factory. R. A. Cook, Milford, Arch.

Ct., Ansonia—American Brass Co. made plans 1- and 2-story, 98 x 320-ft. foundry. About $150,000.

Ct., Torrington—Hendey Machine Co. made plans addition, Summer St., to be used as factory and storehouse.

N. Y., Auburn—Auburn Milk Producers Assn. plans creamery. W. J. Hilliard, Pres.

N. Y., Buffalo—Dowers Manufacturing Co., 1300 Niagara St., plans addition to machine shop. Colson & Dunson, 31 Dun Bldg., making plans.

N. Y., Buffalo—Pullman Co., 79 East Adams St., Chicago, made plans shop. About $1,000,000. Arnold Co., 105 South La Salle St., Chicago, Contract, Engr.

N. Y., Jamestown—International Metal Manufacturing Co., made plans factory No. 3, 3-story, 60 x 100-ft. O. M. Otte, 65 River St., Pres.

N. Y., New York—(Brooklyn)—T. Kiendl, Jr., 2634 Atlantic Ave., made plans 4-story, 50 x 100-ft., brick factory, Georgia and Pitkin Ave. About $20,000. C. Infanger & Son, 2634 Atlantic Ave., Arch.

N. Y., New York—(Brooklyn)—F. Loeser & Co., 484 Fulton St., made plans 1-story, 60 x 100-ft. brick shed, Bond St. About $40,000. W. H. Campbell, 262 East 2nd St., Arch.

N. Y., New York—(Brooklyn)—T. Roulston, 100 9th St., making plans 1- and 2-story, 50 x 200-ft. storage building, 9th and 10th St. About $60,000. W. Higginson, 13 Park Row, Manhattan, Arch.

N. Y., New York—(Manhattan)—Locke & Co., 218 West 84th St., made plans 4-story, 72 x 180-ft., brick and rein.-con. factory, 56th St. and Ave. A. About $100,000. L. M. Gray, 16 West 39th St., Arch.

N. Y., New York—(Manhattan)—J. H. Muller, 513 West 55th St., made plans 8-story, 50 x 90-ft. receiving mill station. J. H. Knubel, 305 West 43rd St., Arch.

N. Y., New York—(Manhattan)—Stern & Saalberg Co., 416 West 45th St., made plans 7-story, 50 x 100-ft. brick and rein.-con. addition. About $75,000. Buchman & Fox, 42nd St. Bldg., Madison Ave. and 42nd St., Arch. Noted Mar. 1.

N. Y., New York—(Manhattan)—Washburn Wire Co., 528 East 118th St., made plans 1- and 5-story, 75 x 100-ft. additions. About $50,000. J. P. Walther, 147 East 125th St., Arch.

N. Y., New York—(Manhattan)—D. C. & C. Young, 312 West 112th St., made plans 2-story, 50 x 94-ft. garage, 512-514 West 161st St. About $25,000. J. J. Lawlor, 360 West 23rd St., Arch. Noted Mar. 15.

N. Y., Salamanca—Buffalo, Rochester & Pittsburgh Railroad Co. plans machine shop, erecting shop and addition to roundhouse. D. S. Watkins, Du Boise, Pa., Engr. Construct.

N. J., Elizabethport—(Elizabeth Post Office)—Nelson Co., 238 44th St., Brooklyn, N. Y., acquired site and will build plant to manufacture cabinets.

N. J., Elizabethport—(Elizabeth Post Office)—Singer Manufacturing Co. made plans extensions to foundry. About $60,000.

N. J., Jersey City—J. Dixon Crucible Co., Monmouth St., plans 3-story addition at 280-84 Mercer St. About $250,000.

N. J., Newark—Whitehouse Novelty Manufacturing Co., 44 Hunter St., plans addition to plant at 107-9 East 17th St.

N. J., Passaic—Armour & Co., Monroe St., plans 4-story, 90 x 90-ft., cold-storage and beef-cooling plant.

N. J., Paterson—Holzman Silk Manufacturing Co., Van Houten St., increased capital stock from $150,000 to $600,000, and will extend plant.

N. J., Paulsboro—Standard Fuse Corp. plans addition. About $50,000.

N. J., Vineland—State Home for Feebleminded Women plans 1-story, 40 x 116-ft. laundry. About $20,000. J. S. Drew, State House, Trenton, will receive bids Apr. 1.

Pa., Allentown—E. S. Gerherdt plans 3-story, 16 x 75-ft. addition, East 10th St.

Pa., Black Lick—Marshall Foundry Co. making plans factory. About $100,000. Noted Feb. 1.

Pa., Chester—Sun Shipbuilding Co. plans 2-story, 50 x 200-ft. joiners' shop.

Pa., Clearfield—A. W. Lee, Jr., receiving bids Apr. 5, 2-story, 50 x 172-ft. commercial garage. About $25,000. A. Rishel, Arch.

Pa., Ephrata—Interstate Feed Machine and Products Co., 642 East Mason St., York, plans plant.

Pa., Erie—Erie City Iron Fence and Wire Works making plans plant, 23rd St. H. E. Barr, Arch.

Pa., Erie—Modern Tool Co., State and 4th St., soon receives bids 1-story, 40 x 145-ft. addition. About $10,000. A. F. Schotte, 405 Palace Hardware Bldg., Arch.

Pa., Phila.—Atlantic Refinery Co. 314 Passyunk Ave., acquired 21 acres land at Jackson St. and Schuylhill Ave. and will build extensions.

Pa., Phila.—S. G. Matthews & Co., 916 North 9th St., iron contractors, making plans 1-story, 40 x 155-ft. factory, 29th and Clearfield St.

Pa., Phila.—F. Weber & Co., making plans 8-story, 42 x 150-ft. factory, 12th and Buttonwood St. H. Miller, Crozer Bldg., Arch.

Pa., Pittsburgh—C. S. Hixon Candy Co., 1224 Vickroy St., plans 4-story, 59 x 96-ft. factory, Adams and Fulton St.

Pa., Pittsburgh—Iron City Products Co. made plans plant to manufacture automobile specialties. W. G. Wilkins Co., Westinghouse Bldg., Arch.

Pa., Pottstown—North American Motors Co. plans 1- and 2-story, brick and steel plant.

Pa., Shamokin—Knepka Silk Mill Co., recently organized with $25,000 capital stock, plans mill.

Md., Baltimore—Alexander Milborn Co., 1418 West Baltimore St., plans enlarging factory.

Md., Baltimore—Maryland Meter Works, Saratoga and North St., plans 6-story, 52 x 94-ft. addition.

Md., Baltimore—National Enameling and Stamping Co., 1901 Light St., made plans 4-story, brick and steel addition. About $50,000 or $60,000.

Md., East Brooklyn—United Motors Fuel Co. plans plant to manufacture gasoline. About $1,000,000. Automobile Chamber of Commerce, 7 East 42nd St., New York, interested.

W. Va., Follansbee—LaBelle Iron Works plans steel plant. About $5,000,000.

W. Va., Huntington—B. G. Cain, 316 6th St., carriage maker, making plans 2-story, 60 x 140-ft. plant. About $20,000. Meanor & Sweeney, 917 R. & P. Bldg., Arch.

W. Va., Wheeling—See item under "Buildings."

N. C., Statesville—Sterling Mills Corp., recently incorporated with $150,000 capital stock, plans flour mill and grain elevator.

Ala., Scottsboro—Stratton & Devine, Chattanooga, plans hosiery mill. About $40,000.

La., Cedar Grove—Marine Oil and Refining Co., recently organized with $500,000 capital stock, plans refinery, 1200 bbls. capacity daily. About $500,000.

La., Shreveport—Henderson Cotton Oil and Manufacturing Co., recently organized with $400,000 capital stock to consolidate several plants, will build mill. R. W. Henderson, Talladega, Ala., Pres.

Ohio, Akron—Enterprise Manufacturing Co., 2172 Ash St., receiving bids Apr. 1, 2-story, addition. About $30,000. F. M. Case, American Trust Bldg., Cleveland, Arch.

Ohio, Ashland—Eagle Rubber Co. made plans 60 x 80-ft. plant. About $18,000.

Ohio, Cincinnati—Crown Overall Co., 3rd and Plum St., making plans 4-story, 182 x 185-ft. factory. About $200,000. Zettel & Rapp, Johnson Bldg., Engr.

Ohio, Cincinnati—Edna Brass Works, Hunt St., plans 2-story, 100 x 100-ft. machine shop.

Ohio, Cincinnati—Marietta Chair Co. plans to extend plant.

Ohio, Cleveland—Grant Motor Car Co. making plans additions to factory. W. S. Ferguson Co., Arch.

Ohio, Cleveland—G. F. Mitchell & Son Co., Cedar and East 65th St., purchased site on East 131st St. and plans factory to manufacture automobile sheet metal parts. About $250,000. G. Mitchell, Pres.

Ohio, Cleveland—Ohio Forge Co., 2186 East 65th St., receiving bids Apr. 2, plant. About $100,000. Burchard, Roberts, Wales Co., Swetland Bldg., Arch. Noted Feb. 1.

Ohio, Columbus—American Water Motor Co., West Spring St., purchased site and plans factory to manufacture motor washing machines.

Ohio, Columbus—Independent Grocers Associated Baking Co., 606 South High St., receiving bids Apr. 1 2-story, 76 x 112-ft. bakery. About $50,000. E. B. Rickett, 274 12th Ave., Arch.

Ohio, Grafton—Bennett Milling Co., formerly known as Valley City Milling Co., plans mill. About $35,000.

Ohio, Kings Mills—Peters Cartridge Co., 1st National Bank Bldg., Cincinnati, plans 2-story packing case building. About $50,000. E. C. Van Leyen and E. A. Schilling, Union Trust Bldg., Detroit, Arch., soon receives bids.

Ohio, Lancaster—Lancaster Glass Co. made plans 1-story, brick factory addition. M. Peterman, 4th and State St., Columbus, Arch.

Ohio, Marietta—Northwestern Chemical Co. increased capital stock from $20,000 to $150,000, and plans additions.

Ohio, Marion—Fairbanks Steam Shovel Co. plans 60 x 300-ft. foundry and power plant including 1000 hp. engine and 800-kv.-a. generator.

Ohio, Newport—Newport Rolling Mills made plans addition to machine shop and generating buildings. Tetig & Co., 510 Vine St., Cincinnati, Arch.

Ohio, New Lexington—Star Manufacturing Co., increased capital stock from $75,000 to $150,000, and making plans addition.

Ohio, New Richmond—Dorner Bros. made plans 3-story, 30 x 70-ft. addition. D. Davis, Fosdick Bldg., Arch.

Ohio, Norwood—Norwood Sash and Door Co. plans 1-story, 40 x 210-ft. warehouse, Section and Ross Ave. C. M. Foster, Arch.

Ohio, Toledo—National Oxygen Co., manufacturer of gas for cutting and welding steel, plans plant.

Ohio, Toledo—Toledo Commutator Co., recently incorporated with $50,000 capital stock, plans factory on Summit St.

Ind., Connersville—Connersville Lumber Co. plans extending plant.

Ind., Frankfort—M. N. Smith & Co., 9 Columbin St., making plans cigar factory. About $50,000. J. F. Sheblesey, Arch.

Ind., Huntington—Fanning Furniture Co. plans concrete storage house, Market and Erie St.

Ind., Huntington—Martin Creamery Co., Markle, purchased site and will remove plant to Huntington as soon as factory is erected.

Ind., Indianapolis—Link-Belt Co. made plans addition to foundry. About $30,000. Noted Mar. 22.

Ind., Indianapolis—Modern Die and Tool Co., 202 South Pennsylvania St., soon receives bids 1- and 2-story, 120 x 151-ft. factory. W. H. Albersmeier, 508 Bauh Bldg., Arch.

Ind., Richmond—Pennsylvania R.R. plans machine, tool and car repair shops. About $530,000. A. C. Shand, Broad St. Station, Phila., Ch. Engr.

Ind., Tipton—Clauss Manufacturing Co. will rebuild plant recently destroyed by fire. About $100,000.

Mich., Detroit—Commerce Motor Car Co. plans 4-story, 100 x 300-ft. addition to plant at Solvay and Machee St.

Mich., Grand Rapids—Nichols Cox Lumber Co. making plans factory. G. L. Stone, 530 Whitticomb Bldg., Arch.

Mich., Muskegon—Campbell, Wyant & Cannon Foundry Co., Manhattan Ave., will rebuild plant recently damaged by fire. About $100,000.

Mich., Port Huron—Monroe Motor Car Co. purchased site and plans addition.

Ill., Abingdon—Abingdon Clay Co., manufacturers hollow building tile, will rebuild plant recently damaged by fire. E. R. Sturtevant, Mgr.

Ill., Belleville—Cabirange Manufacturing Co. increased capital stock from $10,000 to $75,000, and plans new factory.

Ill., Buffalo—Dewey Portland Cement Co., Kansas City, Mont., plans plant. About $2,000,000. F. E. Tyler, Pres.

Ill., Chicago—Berhalter Health Food Co., 1423 North Clark St., making plans 2-story baking plant, Diversey Pkwy. About $200,000. R. Griesser, 64 West Randolph St., Arch.

Ill., Chicago—J. A. Miller made plans 1-story, brick factory at 552-53 West Adams St. About $14,000.

Ill., Chicago—H. I. Molton, 140 South Dearborn St., plans 1-story, 50 x 125-ft. sheet metal shop. About $15,000.

Ill., Chicago—H. A. Howard, 38 South Dearborn St., Chicago, purchased site at Racine Ave. and 21st St. and plans 1-story factory. About $55,000.

Ill., Chicago—Standard Oil Co., 72 West Adams St., plans 7-story addition.

Ill., Freeport—W. T. Rawleigh Co. plans 1-story, 120 x 274-ft. plant. About $400,000. F. D. Chase, 122 South Michigan Ave., Chicago, Arch.

Industrial Works (Continued)

Ill., Kankakee—Illinois Central R.R. plans roundhouse and freight house. A. S. Baldwin, 135 East 11th Pl., Chicago, Ill., Ch. Engr.

Ill., Streator—F. Angier, 116 North Bloomington St., soon receives bids 1-story, 50 x 150-ft. machine shop. A. W. Allen, 410 East Main St., Arch.

Ill., Waukegan—Chicago Hardware Foundry Co., 546 West Washington Blk., plans additions.

Wis., Campbellsport—S. J. Stevens Co., Sheboygan, plans cold-storage plant.

Wis., Fond du Lac—Damrow Bros. Co. increased capital stock from $25,000 to $75,000, and will build addition.

Wis., Milwaukee—Davis Manufacturing Co. soon lets contract 100 x 300-ft. brick, steel and concrete foundry unit at 57th Ave. and Mitchell St. G. W. Kliegel, Secy. and Treas.

Wis., Milwaukee—Gem Hammock and Fly Net Co., 326-30 Florida St., plans 2-story, 20 x 60-ft. addition. About $30,000. P. E. Schaefer, 296 West Water St., Arch.

Wis., Milwaukee—Jaeschke Bros. Foundry plans addition to foundry at 3026 Locust St.

Wis., Milwaukee—Wisconsin Telephone Co. making plans 108 x 127-ft. warehouse, garage and repair shop. About $60,000. W. O. Seymour, 183 5th St., Supt. A. C. Eschweiler, Goldsmith Bldg., Arch.

Wis., Plymouth—Plymouth Foundry and Machine Co., Stafford St., made plans 1-story, 60 x 150-ft. foundry. Klug & Smith, 40 Mack Bldg., Milwaukee, Arch.

Wis., Shawano—R. C. Een made plans 2-story, 50 x 60-ft. creamery. About $12,000. E. M. Koben, Citizens National Bank Bldg., Arch.

Ia., Davenport—L. M. Allen and C. Keller plans 89 x 166-ft. garage at 311 East 3rd St. About $20,000.

Minn., Minneapolis—Kellogg Kackay Co., 826 4th St., plans 2-story, brick and rein.-con. warehouse, 9th Ave. and 4th St.

Minn., Newport—Farmers Terminal Packing Co., 919 Commerce Bldg., St. Paul, making plans packing plant. About $400,000. Haugen-Newstrom Co., Iron Exchange, Minneapolis, Arch.

Kan., Wichita—E. E. Fisher, c/o Middle-West Mercantile Co., soon receives bids 2-story, 40 x 50-ft. dairy. About $10,000.

Neb., Blair—G. Rathman made plans 2-story, garage. About $40,000.

Neb., Omaha—Hogeland Lumber Co., 9th and Douglas St., receiving bids Apr. 20, 4-story brick warehouse. About $200,000. T. R. Kimball, 836 World Herald Bldg., Arch.

N. D., Dawson—Southside Farmers Union, Inc., plans warehouse.

N. D., Fargo—Equity Packing Co. receives bids in April 4-story, 150 x 192-ft. packing plant. About $300,000.

N. D., Grand Forks—Northern Packing Co. made plans packing plant. Croft & Boerner, 801 Palace Bldg., Minneapolis, Minn., Arch.

N. D., Taylor—Farmers Elevator Co. plans grain elevator, 50,000-bbls. capacity. About $10,000.

Mo., Bucklin—Lindley Bustee Poultry Co. receiving bids Apr. 5, 1- and 2-story brick creamery and cold-storage building. About $16,000.

Mo., Kansas City—Martin E. Ditzler, 321 Garfield St., made plans 2-story, 44 x 145-ft., plant. About $10,000. F. E. Parker, 604 Kemper Bldg., Arch.

Mo., St. Joseph—Diamond Motor Co. made plans 2-story, 60 x 140-ft. garage, 5th and Jule St. A. S. Clark, Local Mgr.

Mo., St. Louis—St. Louis Union Trust Co., 4th and Locust St., soon receives bids 2-story, 103 x 144-ft. public garage. About $20,000. I. T. Pendleton, 705 Olive St., Arch.

Mo., St. Louis—See item under "Light, Heat and Power."

Mo., Union—Hamilton-Brown Shoe Co., 1144 Washington Ave., St. Louis, receiving bids Apr. 1, 4-story, 50 x 150-ft. addition. I. S. Taylor, Mercantile Trust Bldg., St. Louis, Arch.

Tex., Dallas—T. Burnett plans mattress factory. About $100,000.

Tex., Dallas—Miller Bros. plan cotton mill. About $500,000.

Tex., Sulphur Springs—Crystal Ice Co. will let contract in April 90 x 105-ft. cold-storage house. About $35,000. E. R. Brinkler, Mgr. G. E. Wells, St. Louis, Arch. and Engr.

Okla., Claremore—American Refining Co. of Oklahoma soon lets contract refinery. About $110,000.

N. M., Hanover—Hanover Besseman Iron and Copper Co. plans rebuilding mill and power plant recently destroyed by fire.

N. M., Las Cruces—Holly Sugar Corp., Holly, Colo., purchased site in Las Cruces, and plans beet sugar refinery. About $1,000,000.

Wash., Tacoma—Keystone Cereal Co. plans flour mill, capacity 400 bbl. daily. About $130,000.

Calif., Modesto—L. A. Lundy, of L. A. Lundy Dried Milk Products Co., 3 Franklin St., San Francisco, recently incorporated with $100,000 capital stock, plans factory in Modesto to manufacture dried milk products and will install machinery for dehydration of milk and manufacture of byproducts from dessicated residue. Company plans chain of similar plants through San Joaquin Valley. G. Bauer, Vice-Pres.

Que., Montreal—Northern Toy and Turning Co., Ltd., 703 Power Bldg., plans factory. About $100,000.

Ont., Brampton—Gummed Paper Co., Ltd., plans 2-story addition.

Ont., Deseronto—Imperial Munitions Bd., Ottawa, plans aëroplane plant. About $3,000,000. J. W. Flavelle, Chn. Bd.

Ont., London—Gorman Eckert Co., Rectory St., soon receives bids 3-story addition to factory. About $20,000. Watt & Blackwell, Bank of Toronto Bldg., Arch.

Ont., Toronto—Queen City Foundry Co. plans foundry on Ashbridges Bay. About $12,000.

Ont., Windsor—Kelsey Wheel Co., manufacturer of bodies and wheels for automobiles, plans additions.

Man., Winnipeg—City Dairy Co., Ltd., 234 Pritchard Ave., plans dairy. About $20,000. B. Fratlin, Mgr.

B. C., Matsqui—Craig & Taylor plan lumber mill, 50,000 to 60,000 ft. capacity.

Bids In and Contracts Awarded

N. H., Nashua—Wonalancet Co. let contract mill to G. W. KEITH, 210 Main St.

Mass., Boston—Armour & Co., 43 Commercial St., let contract warehouse to NORCROSS BROS., Tremont Bldg. Noted Feb. 8.

Mass., New Bedford—Continental Wood Screw Co. let contract 3-story mill to EASTERN CONSTRUCTION CO., Winter St., Woonsocket, R. I.

Mass., Springfield—H. W. Carter Paper Co., 233 Worthington St., let contract warehouse to F. F. CARLSON CO., 310 Main St.

Mass., Watertown—Hood Rubber Co., Melendy Ave., let contract factory to W. H. ILIFFE, Melendy Ave. About $35,000. Noted Mar. 8.

R. I., Warwick—Gallandet Aircraft Corp. let contract factory to SODERLAND BROS., Bicknell Ave., East Greenwich, $12,000.

R. I., Woonsocket—Woonsocket Machine and Press Co., 533 2nd Ave., let contract addition to EASTERN CONSTRUCTION CO., 660 Winter St., $12,000.

Ct., New Haven—F. B. Shuster Co., Mill River St., let contract addition to HUBBELL, MERWIN CO., 21 Artisan St.

N. Y., Jamestown—Jamestown Auto Parts Manufacturing Co., 100 State St., let contract factory to JAMESTOWN CONSTRUCTION CO., 60 River St. Noted Feb. 22.

N. Y., New York—(Brooklyn)—Century Pump Co., 428 3rd Ave., let contract factory, East 6th St., to L. MERTZ, 850 St. Johns Pl., $9000.

N. Y., New York—(Brooklyn)—Eberhard Faber Pencil Co., 39 Greenpoint Ave., let contract factory to C. C. WOODRUFF & CO., 213 10th St., Long Island City, $100,000. Noted Mar. 22.

N. Y., New York—(Brooklyn)—L. Shepeloff, 566 Liberty Ave., will build 3-story, 40 x 57-ft. shop and garage by day labor. About $20,000. C. Infanger & Son, 2634 Atlantic Ave., Arch.

N. Y., New York—(Manhattan)—P. Englander, 474 Broadway, let contract 1-story garage to RIGER CONSTRUCTION CO., INC., 489 5th Ave., $20,000.

N. Y., New York—(Manhattan)—A. W. Smith, c/o Jacob & Simon, 430 Broadway, let contract garage, Broadway to KLEIN & JACOB, 430 Broadway, $40,000.

N. Y., New York—(Queens)—E. R. Durlee & Co., 534 Washington St., Manhattan, let contract 4-story, rein.-con. factory, Corona Ave. and Railroad and Hampton St. and Court Pl., Elmhurst, to INDUSTRIAL ENGINEERING CO., 30 Church St., Manhattan, $400,000.

N. Y., Utica—Utica Knitting Co., 1712 Erie St., let contract addition to R. RICHARDS & SON, 246 Elizabeth St.

N. J., Camden—(Official)—W. F. Taubel, Inc., let contract addition to H. B. MILLER, Edgewater Park.

N. J., Newark—R. Neumann Hardware Co., 9 St. Francis St., let contract addition to J. J. O'LEARY, 500 Bloomfield Ave., Passaic, $150,000. Noted Mar. 8.

Pa., Allentown—International Motor Co. let contract addition to BUTZ & CLADER, Ainey Bldg., $20,000.

Pa., Allentown—Wetherhold & Metzger, shoe merchants, let contract plant, Hall and Hamilton St., to RITTER & SMITH, $75,000.

Pa., Altoona—A. N. Cherry & Son, 2705 Broad Ave., will build commercial garage by day labor. About $40,000.

Pa., Manheim—Stehli Silks Corp. let contract silk mill to J. P. BRENEMAN, Rossmer.

Pa., Phila.—Morris Wheeler & Co. let contract 1- and 2-story garage, 30th and Locust St., to W. STEELE & SONS CO., 1600 Arch St., $40,000.

Pa., Phila.—Windsor Chocolate Co. let contract factory, 6th and Moore St., to W. STEELE & SONS CO., 1600 Arch St., $40,000.

Ala., Dothan—J. E. Wright, River Falls, contract pickle factory to J. W. BAUGHMAN.

Ohio, Ashland—Ashland Products Co., recently incorporated with $100,000 capital stock, let contract plant to M. H. MORR.

Ohio, Cincinnati—Champion Tool Works Co., 2420 Spring Grove Ave., let contract plant to F. W. FOLZ, $60,000. Noted Mar. 22.

Ohio, Cincinnati—Queen City Livery Co., 5[illegible] Clark St., let contract 1-story addition to garage to W. MILLER & SON, $20,000. Noted Mar. 2[illegible]

Ohio., Cleveland—Adams-Oakland Co., 57[illegible] Euclid Ave., let contract garage and office to FRASER CONSTRUCTION CO., 1900 Euclid Ave. $40,000.

Ohio, Cleveland—Cleveland & Sandusky Brewing Co., West 25th and Carroll St., let contract addition to D. LINDHORST CONSTRUCTION CO. American Trust Bldg., $20,000.

Ohio, Fostoria—Allen Motor Co. let contract auto manufacturing plant to BELLEFONTAINE IRON AND BRIDGE CO., Bellefontaine, $300,000. Noted Mar. 15.

Ohio, Fostoria—Dale Body Co. let contract auto body plant to BELLEFONTAINE IRON AND BRIDGE CO., Bellefontaine, $100,000. Noted Mar. 22.

Ohio, Fostoria—Faultless Anchor Co. let contract addition to J. SHAFER, Burgoon. Noted Mar. 15.

Ill., Chicago—Iroquois Iron Co., 3267 East 95th St., let contract plant to H. METSICK, $23,000.

Ill., Chicago—J. A. Miller, 427 North Ashland Ave., let contract engraving building to MEINZ & FLAHERTY, 847 Bradley Pl., $14,000. Noted Mar. 22.

Ill., Sycamore—Chicago Insulated Wire and Manufacturing Co., 53 West Jackson St., Chicago, let contract factory and office building to SKOGLUND & WEDBERG, 620 7th St., DeKalb, $50,000. Noted Mar. 8.

Wis., Eau Claire—Gillette Safety Tire Co., 316 South Barston St., let contract addition to R. L. RICKMAN, c/o Commercial Hotel, $35,000.

Wis., Horicon—Ideal Barn Equipment Co., incorporated with $50,000 capital stock, let contract plant to HUTTER CONSTRUCTION CO., Fond du Lac., $25,000.

Wis., Milwaukee—Falk Co., 30th St., let contract plant to WORDEN-ALLEN CO., 208 South LaSalle St., Chicago, $60,000.

Ia., Davenport—Davenport Manufacturing Co. let contract factory to McCARTHY IMPROVEMENT CO., $35,000. Noted Mar. 22.

Ia., Sioux City—Pinslow Estate let contract machine shop and garage to KINCAIN & LONGENECKER, 310 United Bank Bldg., $30,000.

Minn., Shakopee—J. Ries Bottling Works will build 1-story, 35 x 70-ft. addition to bottling house by day labor. About $10,000. P. J. Linhoff, 906 Germania Life Bldg., St. Paul, Arch. Noted Jan. 25.

Neb., Omaha—Burns Baking Co. let contract plant, 20th and Cumming St., to J. HARTE, $20,000. Noted Mar. 1.

Neb., Omaha—T. Jones, 1116 Dodge St., let contract garage and warehouse to G. W. S. RAGUE, Franklin, $25,000.

Mo., Kansas City—F. H. Thwing, 216 Finance Bldg., let contract garage to J. W. FLANAGAN CONSTRUCTION CO., 2836 Benton Blvd., $20,000.

Mo., St. Louis—Medart Patent Pulley Co., 3500 De Kalb St., let contract factory to J. H. WISE, Victoria Bldg., $30,000.

Mo., Springfield—D. M. Oberman Manufacturing Co., Water and Boonville St., let contract overall factory to J. M. MILLIKEN, $60,000.

Okla., Tulsa—Nichols Warehouse Co., 1 North Boulder St., let contract warehouse to FIDELITY BUILDING CO., 218 Ohio Bldg., $27,000.

Calif., Los Angeles—F. W. Braun let contract creamery plant, 1006 West Slauson Ave., to N. NELSON, $10,000.

FEDERAL GOVERNMENT WORK

Proposed Work

Me., Portland—Post Office—J. A. Wetmore, Act. Superv. Arch., Treasury Dept., Wash., receiving bids Apr. 27.

Pa., Ft. Mifflin—(Phila. post office)—Buildings—Bureau Yards and Docks, Navy Dept., Wash., made plans 1 magazine and 1 shell house. About $70,000.

Md., Indian Head—Buildings—Bureau Yards and Docks, Navy Dept. Wash. made plans covering 3 powder dry houses and 1 tide bridge for Naval Proving Ground.

Wash., D. C.—Bridge—Secy. Bd. Comrs., Room 509, Dist. Bldg., receiving bids Apr. 6, concrete bridge in line of 16th St., N. W. crossing Millitary Rd. Noted Mar. 22.

Wash., D. C.—Gun Shop—Bureau of Yards and Docks, Navy Dept., receiving bids Apr. 9 at Navy Yard, Wash. F. R. Harris, Ch. Noted Mar. 15.

Federal Government Work (Continued)

Wash., D. C.—Hangars—War Dept., Office Ch. Signal Officer, receiving bids Apr. 9 seaplane and airplane hangars in basic units 4 to 64, Proposal No. 941.

Va., Norfolk — Refrigerating Plant — Bureau Yards and Docks, Navy Dept., Wash., receiving bids Apr. 9 self-contained refrigerating machines, piping, connections and accessories necessary for replacing existing plant in Naval Hospital. F. R. Harris, Ch. Noted Mar. 22.

N. C., Burlington—Post Office—J. A. Wetmore, Act. Superv. Arch., Treasury Dept., Wash., revoked contract recently let to McAdams & Mitchell, and will soon relet to another bidder. Noted Feb. 15.

S. C., Charleston—Shipbuilding Crane—Bureau Yards and Docks, Navy Dept., Wash., receiving bids Apr. 9 at Navy Yard. F. R. Harris, Ch. Noted Mar. 15.

S. C., Columbia—Post Office—J. A. Wetmore, Act. Superv. Arch., Wash., receiving bids May 15.

La., New Orleans—Sewage Pumping Plant—Bureau Yards and Docks, Navy Dept., Wash., extended date receiving bids from Mar. 26 to Apr. 9. F. R. Harris, Ch. Noted Mar. 15.

Tenn., Chattanooga—Post Office—J. A. Wetmore, Act. Superv. Arch., Treasury Dept., Wash., receiving bids May 4.

Ill., Rock Island—Turbine Unit—Commanding Officer, Rock Island Arsenal, receiving bids Apr. 5, 1 hydraulic turbine unit complete and 1 additional curb ring.

Wyo., Powell—Canals—U. S. Rec. Ser., Powell, receiving bids Apr. 18, 30,000 cu.yd. excavation for canals on Shoshone Project, 2d Unit, Frannie Div., near Mantua on Chicago, Burlington & Quincy R.R. A. P. Davis, Ch. Engr.

Mont., Malta—Earthwork—U. S. Rec. Ser., Malta, receiving bids Apr. 25 Nelson Reservoir, South Canal, Milk River Project, about 10 mi. from Saco.

Mo., St. Louis—Levee—Secy. Mississippi River Comn., 1311 International Life Bldg., receiving bids Apr. 9, 259,000 cu.yd. earthwork in Sny Island Levee Drainage Dist.

Tex., Commerce—Post Office—J. A. Wetmore, Act. Superv. Arch., Treasury Dept., Wash., receiving bids May 1.

Wash., Keyport—Magazine—Bureau Yards and Docks, Navy Dept., Wash., receiving bids Apr. 23, for war heads at Keyport. F. R. Harris, Ch. Noted Mar. 22.

Bids In and Contracts Awarded

N. H., Portsmouth—Air Compressor—Bureau Yards and Docks, Navy Dept., Wash., let contract to INGERSOLL-RAND CO., 111 Broadway, New York, $51,560.

Mass., Woods Hole—Wharf—Treasury Dept., U. S. Coast Guard, Wash., let contract to RENDLE-STODDARD CO., Chelsea, $14,299. Noted Mar. 22.

Mass., Woods Hole — Storehouse — Lighthouse Inspector, Boston, received low bids Feb. 27 from Morgan Construction Co., $15,161; J. O. Safford & Co., Inc., $15,377; T. O. Bourne, $16,182.

Ct., New London—Heating System—Bureau Yards and Docks, Navy Dept., Wash., received low bids, Mar. 19, complete steam heating system at Naval Submarine Base from M. J. Daly & Son, Waterbury, $14,043; Newport Engineering and Contracting Co., Newport News, Va., $14,274; Nolan-Clifford Co., Newport News, Va., $16,328.

N. Y., Buffalo—Buildings—U. S. Engr. Office, Buffalo, received only bid office storehouse and 6 operating houses at Black Rock Lock and storehouse at Ferry St. Bridge from C. H. Everitt, 295 Auburn Ave., Buffalo, terra cotta trimmings, $172,252; cut cast stone trimmings, $169,827. Noted Feb. 22.

Pa., Phila.—Cranes—Bureau Yards and Docks, Navy Dept., Wash., let contract covering cranes at Navy Yard to NILES-BEMENT-POND CO., 111 Broadway, New York, $119,202. Noted Mar. 1.

Pa., Phila.—Slips—Bureau Yards and Docks, Navy Dept., Wash., D. C., received bids Mar. 19 shipbuilding slips, (1a) slip 2, straight bid, (1b) time of completion in days, (1c) bid evaluated, taking into consideration comparative time of completion, (2a) slips 2 and 3, straight bid, (2b) time of completion in days, (2c) bid evaluated, from Porter Bros., Wilkes-Barre, (1a) $429,392, (1b) 160 days (1c) $429,392, (2a) $858,784, (2b) 250 days, (2c) $858,784; H. P. Converse Co., 88 Broadway, New York, (1a) $425,621, (1b) 300 days (1c) $453,621, (2a) $815,405, (2b) 440 days, (2c) $873,405; Snare & Treist Co., New York, (1a) $373,780, (1b) 250 days, (1c) $391,780, (2a) $724,720, (2b) 360 days, (2c) $746,720; J. Stewart & Co., 30 Church St., New York, (1a) $420,963, (1b) 245 days, (1c) $437,936, (2a) $809,478, (2b) 365 days, (2c) $832,478; Stewart Engineering Co., 17 Battery Pl., New York, (1a) $450,626, (1b) 180 days, (1c) $454,626, (2a) $901,252, (2b) 280 days, (2c) $907,252; Foundation Co., 233 Broadway, New York, (1a) $394,191, (1b) 270 days, (1c) $416,191, (2a) $769,002, (2b) 450 days (2c) $809,002; Sanford & Brooks, 24 Commerce St., Baltimore, (1a) $443,069, (1b) 364 days (1c) $483,860, (2a) $886,120 (2b) 364 days, (2c) $908,920. Noted Mar. 15.

Del., Wilmington—Dredging—U. S. Engr. Office, Old Federal Bldg., Wilmington, received only bid in Chester River from Delaware Dredging Co., 843 Real Estate Trust Bldg., Phila., 48c. per cu.yd., place measurement. Noted Mar. 1.

Wash., D. C.—Power Plant Equipment—Bureau Yards and Docks, Navy Dept., Wash., received bids Mar. 21, comprising turbo-alterators, exciters, panels, switchboards, condensers, pumps and auxiliaries, stokers, fans and equipment for concrete oil switch structures with wiring for control of generators, exciters and feeders from W. G. Cornell Co., 923 12th St., $254,000, or cost plus 25%; General Electric Co., Schenectady, N. Y., $199,121, or cost plus 25%; Allis-Chalmers Co., 50 Church St., New York, on bidders' specifications. Noted Mar. 22.

Ga., Statesboro—Post Office—J. A. Wetmore, Act. Superv. Arch., Treasury Dept., Wash., let contract to WISE GRANITE AND CONSTRUCTION CO., Richmond, Va., $40,850. Noted Mar. 22.

Fla., Pensacola—Wharf and Boathouse—U. S. Coast Guard, Wash., received low bids at Station No. 215, Santa Rosa Island, from C. H. Turner Co., Pensacola, $6598; Monk & Eley, Pensacola, $7280. F. E. Grohne, Pensacola, $8192. Noted Feb. 8.

Miss., Holly Springs—Post Office—J. A. Wetmore, Act. Superv. Arch., Wash., received bids Mar. 23 from A. Blair, Montgomery, Ala., $41,100; W. D. Lovell, 1415 8th St., S. E., Minneapolis, Minn., $42,610. Noted Feb. 22.

Tenn., Martin—Post Office—J. A. Wetmore, Act. Superv. Arch., Treasury Dept., Wash., let contract to E. A. STEININGER CONSTRUCTION CO., Victoria Bldg., St. Louis, $39,872. Noted Mar. 22.

Ky., Marion—Post Office—J. A. Wetmore, Act. Superv. Arch., Treasury Dept., Wash., let contract to A. W. LANE, 19 South La Salle St., Chicago, $35,710. Noted Mar. 22.

Ohio, Martins Ferry—Post Office—J. A. Wetmore, Act. Superv. Arch., Treasury Dept., Wash., received low bids Mar. 21 from J. G. Unkefer & Co., Minerva, $35,500; A. W. Lanes, 19 South La Salle St., Chicago, $36,223; Westchester Engineering Co., White Plains, N. Y., $38,979. Noted Feb. 22.

Mich., Grand Haven—Revetment—U. S. Engr. Office, Grand Rapids, let contract pile substructure and concrete superstructure north revetment Grand Haven Harbor to R. LOVE & SON, Muskegon, $24,197. Noted Mar. 22.

Mich., Grand Rapids—Revetment—U. S. Engr. Office, Grand Rapids, received bids Mar. 12 pile substructure and concrete superstructure north revetment at Ludington Harbor from N. P. Nelson, Muskegon, $19,490; I. J. Lyons, St. Joseph, $23,074; R. Love & Son, Muskegon, $25,912. Noted Feb. 22.

Mich., Marquette—Breakwater—E. H. Schulz, Col. Corps Engrs., U. S. Army, received bids Mar. 9 furnishnig and placing rock on breakwater, Marquette Harbor, from T. L. Durocher, Marquette, $55,846; Zenith Dredge Co., 303 Glencoe Bldg., Duluth, $61,996; F. H. Chandler, 614 Torrey Bldg., Duluth, $69,946.

Ill., Savanna—Post Office—J. A. Wetmore, Act. Superv. Arch., Treasury Dept., Wash., let contract to SCHMIDT BROS. CONSTRUCTION CO., 74 West Washington St., Chicago, $39,940. Noted Mar. 15.

Wis., Milwaukee—Caisson Breakwater, Etc.—U. S. Engr. Office received bids rein.-con. caisson breakwater, pile pier, removing old timber crib pier, moving timber cribs and dredging at Racine Harbor from Greiling Bros. Co., Green Bay, $150,471; Great Lakes Dredge and Dock Co., Milwaukee, $173,991. E. E. Gillen Co., Milwaukee, $199,561. Noted Feb. 15.

Kan., Hiawatha—Post Office—J. A. Wetmore, Act. Superv. Arch., Treasury Dept., Wash., let contract to H. L. SPRADLING & CO., Odd Fellows Bldg., St. Louis, $38,750. Noted Mar. 22.

Tex., San Antonio—Tower—Custodian, U. S. post office, received low bids repairs to stone work of tower from Grohne Contracting Co., Joliet, Ill., $8497, $1137 to be deducted if rock face untouched; R. J. Templin, San Antonio, $10,600, alternate deduct $700; J. Roumspoah, Jr., San Antonio, $14,600, alternate deduct $600.

Wash., Bremerton—Heating and Power Plant—Bureau Yards and Docks, Navy Dept., Wash., received low bids, Mar. 19, Naval Torpedo Station, Puget Sound (a) Government specifications, (b) bidders specifications, from Brooks, Kiehl & Whipple, Central Bldg., Seattle, (b) $24,415; C. C. Moore & Co., San Francisco, (a) $28,741, (b) $27,898; J. W. Danforth Co., Buffalo, (a) $28,747. Noted Feb. 15.

CANALS, DITCHES AND IRRIGATION

Proposed Work

N. Y., New York—(Queens)—Drainage—H. Emerson, Pres. Bd. Health, Centre & Walker St., Manhattan, receiving bids Apr. 4 furnishing all labor, materials and equipment necessary to ditch, drain, fill or otherwise improve certain areas in Salt Marshlands and meadows in College Point Sect.

Miss., Biloxi—Drainage—City plans drainage system to take care of excessive water and sewage. J. V. Hagan, City Clk.

Miss., Marks—Ditch—Quitman County receiving bids Apr. 5, 1,200,000 cu.yd. ditch excavations, ditch 37 mi. long, 8 ft. deep, bottom width 14 to 40 ft., side slopes ½ to 1; 183,000 cu.yd. levee embankment, average fill about 6 ft.; 500 lin.ft. standard 14-gage corrugated drainage pipe. H. D. Glass, Pres. Drainage Comrs.

La., New Orleans—Canal—Dock Bd. plans industrial canal for shipbuilding purposes. New Orleans Real Estate Bd., interested.

Tenn., Huntingdon — (Official)—Reclamation—Drainage Dist. No. 1, Carroll County, soon receives bids about 1,250,000 cu.yd. excavation, floating dredge work. W. Enochs, County Judge, Chn. Bd. Dir. A. A. Oldfield, Huntingdon, Drainage Engr. Noted Aug. 17.

Ohio, Fremont—Drainage—Sandusky, Wood and Seneca Counties plan draining Mud Creek. About $79,000. A. Weaver, Fremont, Comr. Sandusky County.

Ohio, Fremont—Ditch—Sandusky County plans improving Peoples Ditch. About $15,000. Address County Clk., Fremont.

Ohio, Lima—Ditch—Allen County comrs. sold $20,880 bonds to improve ditches. Address County Clk., Lima.

Ind., Dunkirk—Ditch—F. F. Glancy, Hartford City, County Surv., receiving bids Apr. 9, S. E. Mozingo Ditch, Shadyside Addition, 1610-ft.

Ind., Peru—Ditch—P. R. Miller, Construct. Comr. Miami County, receiving bids Mar. 31 Timothy B. Baker et al Ditch, Perry Township.

Ill., Carrollton—Drainage—Spankey Drainage and Levee Dist., Greene County, receiving bids Apr. 7 3¾-mi. earth levee, involving 110,000-cu.yd. excavation and open drainage ditch about 2¼ mi., 27,000-cu.yd. excavation, complete pumping station. Address County Clk., Carrollton.

Ill., Peoria—Drainage—Banner Special Drainage and Levee Dist., Peoria and Fulton Counties, asked county court for $55,770 to be levied as special assessment or tax for drainage purposes. G. Houston, Comr.

Ia., Sibley—Drainage—Osceola County, receiving bids Apr. 2, improving Drainage Dist. No. 34, involving 7122-ft. sewer pipe. L. A. Wilson, Sibley, County Engr.

Ia., Winterset—Drainage—Madison County receiving bids Apr. 4 tile drainage. About $11,141. C. D. Norman, Winterset, County Audr.

Minn., Caledonia—Drainage—See item under "Sewers."

Minn., Fairmont—Ditch—Martin County plans Judicial Ditch No. 73. About $33,365. H. C. Nolte, Fairmont, County Audr.

Minn., Warren—Ditch—Marshall County receiving bids Apr. 6 Judicial Ditch No. 29, involving 386,227 cu.yd. excavation, grading, culverts and bridges. A. G. Lundgren, Warren, County Audr. Noted Feb. 1.

S. D., Clear Lake—Drainage—Deuel County receiving bids Apr. 6 drainage ditch and laying tile. J. M. Wold, Clear Lake, County Audr.

S. D., Woonsocket—Drainage—Sanborn County receiving bids Apr. 12, 3½-mi. tile drains, Drainage Dist. No. 29, about $17,000; 10.2-mi. in Dist. No. 25, about $22,000. Dakota Engineering Co., Mitchell, Engr.

N. D., Fargo—Drain—Cass County Drainage Bd. plans Drain No. 14. W. A. Tucker, Fargo, County Audr.

Mo., St. Louis—Reclamation—Missouri State Rec. Ser. retained engineer to make plans and submit estimated cost of reclaiming a 3-acre manufacturing site property on North St. Louis. Proposed improvements include property situated east of Broadway between Riverside Drive and Calvary Ave. Land will be filled in and creek diverted to run waters through huge sewer. J. C. Grether, Chn. Comm. Industrial Dept., Missouri, Kansas & Texas Ry., St. Louis, Interested.

Ark., Arkansas City—Drainage—Southeastern Arkansas Levee Drainage Dist. receiving bids Apr. 10 for purchase of $1,000,000 bonds for drainage work and levees in Desha, Chicot, and Lincoln Counties. Address Clk. Desha County, Arkansas City. Noted Mar. 1.

Ark., Conway — Drainage — Commercial Club asked St. Louis, Iron Mountain and Southern Ry. to send engineer to assist B. G. Wilson, City Engr., in estimating cost of concrete drainway to replace present ditch along company's tracks through city.

Ark., Harrisburg—Drainage—Bill passed Legislature forming Drainage Dist. No. 7 to cover territory of old Dist. No. 2 and several miles more, including territory from Crowley's Ridge to St. Francis River, also providing for cutting canal down bay and 1 down Sand Slough in Poinsett County. J. G. Grant, Harrisburg, County Comr.

Nev., Reno—Irrigation—City plans storage reservoir by means of irrigating land from Dig Creek, Sierra County, Calif. About $20,000. H. C. Chism, City Engr.

Calif., Berkeley—Irrigation—W. P. Boone applied State Water Comn., Sacramento, for permission to irrigate 1,200,000 acres land in Fresno, Tulare, and Kings Counties by means of diverting 20,000 ft. water per second from Kings River. About $9,000,000.

Calif., Colusa—Irrigation—Blevins Mallon Ditch Co. applied to State Water Comn. Sacramento for appropriation to irrigate 4500 acres land from Sacramento River in Colusa County. About $80,000.

Canals, Ditches and Irrigation (Continued)

Calif., Merced—Irrigation—Merced County applied to State Water Comn. Sacramento for appropriation to irrigate 1926 acres land from Merced River. About $10,000. J. R. Ruddle, Snelling, interested.

Calif., San Diego—Irrigation—Bd. Supervs., San Diego County receiving bids Apr. 2 system and pipe line on portion of Pueblo Lot 1118, Pueblo Lands. J. T. Butler, San Diego, County Clk.

Ont., Welland—Canal, Etc.—Dept. Railways and Canals making plans and surveys canal and river system from Lake Ontario to Montreal to be known as Welland Ship Canal.

Bids in and Contracts Awarded

N. Y., Albany—(Official)—Barge Canal Work—W. W. Wotherspoon, State Supt. Pub. Wks., 55 Lancaster St., let contract, Erie, Oswego and Champlain Canals, Contract No. 154, to LUPFER & REMICK, 542 Ellicott Sq., Buffalo, $9057; Contract No. 159, O. M. LUDINGTON'S SONS, INC., Rochester, $28,476; Terminal Contract No. 36, TROY PUBLIC WORKS CO., Utica $57,600. Noted Mar. 8.

N. Y., New York—(Queens)—(Official)—Drainage—Dept. of Health, Manhattan, received low bids (a) furnishing all labor and material and equipment necessary or required to ditch, drain, fill or otherwise improve certain areas in salt marshlands and meadows located in Flushing, Newtown and Elmhurst, (b) same in Kissena Park Sect., from T. F. Ruphy & Co., 89 Main St., Flushing, (a) $12,000; H. I. Eaton, (a) $13,980; J. Macarthur Co., 22 Ormond Pl., Brooklyn, (a) $14,250, (b) $6890; Peace Bros., 20 Main St., Flushing, (b) $4981; A. M. Hazell, 26 Cortland St., Manhattan, (b) $7965.

S. C., Anderson—(Official)—Canal—Bd. Drainage Comrs. Eighteen Mile Creek Drainage Dist. let contract drainage canal along Eighteen Mile Creek in Anderson, Pickens and Oconee Counties to W. A. WATSON, R. F. D., Anderson, 408,000 cu.yd. dirt excavation, $.0594 per cu.yd., 3,000 yd. stone, $2 per cu.yd. Noted Mar. 1.

La., Marksville—Drainage—Red River Atchafalaya & Bayou Boeuf Levee Bd., Alexandria, let contract drainage canal in Avoyelles Parish from Yellow Bayou to Turner Bayou, 75,000 cu.yd., to PICARD, BURKMASTER & WEIL, New Orleans, 18.87c. per cu.yd.

Ky., Morganfield—(Official)—Drainage—Bd. Drainage Comrs. Union County received low bids J. A. Roberts public ditch as follows: F. C. Morgan, Indianapolis, 225,000 cu.yd. main ditch, 12c. per cu.yd., 40,000 cu.yd. lateral ditches, 15c., 80 acres clearing, $20 per acre; J. FOOHEY & CO., Ft. Wayne, Ind., main ditch, 12½c., laterals, 15½c., clearing, $30. F. E. Kersey, Owensboro, Ky., main ditch, 13.4c. laterals, 17c., clearing, $25. N. R. Orcutt, Morganfield, Ch. Engr. Noted Mar. 8.

Ind., Noblesville—Ditch—Hamilton County let contract Joseph W. Wolverton Ditch, Cicero and Jefferson Township, to C. T. HORNBACK, $5049.

Ill., Arthur—(Official)—Drainage—Cadwell Drainage Dist. let contract 60,000 cu.yd. ditch and 3 iron bridges to C. LEW"S. Deland, 17¾c. per cu.yd. Noted Mar. 1.

Ill., Carmi—(Official)—Ditch—White County let contract to A. P. PUMPHREY, Mannie, 18 and 22c. per yd.

Ill., Danforth—Drainage—Village let contract to J. CARTY.

Wis., Elkhorn—Drainage—Troy Drainage Comn., Walworth County, let contract system to NORTHWESTERN DRAINAGE CO., Grand Rapids, $50,590. Noted Feb. 22.

Ia., Adel.—Drainage—Dallas County let contract Dist. No. 46 to HOOVER LUMBER CO., Dallas Center, tile, $7967; S. M. GRANT, Lake City, labor, $4127.

Ia., Glenwood—Drainage—Bd. Supervs. Mills County let contracts drainage ditches to WILSON CONCRETE CO., Red Oak, concrete pipe; IOWA PURE IRON CO., Des Moines, iron culvert pipe; STANDARD BRIDGE CO., Omaha, bridge lumber; F. J. WALLACE LUMBER CO., Glenwood, wood bridge piling.

Ia., Nevada—Drainage—Bd. Supervs. Story County let contract Grant Township Drain No. 78 to BLAKEMORE & SCOTT, $5000.

Ia., Winterset—Drain—Madison County let contract Drain No. 4 to C. L. HANSEN, $8315.

Minn., Benson—(Official)—Ditch—Swift County let contract Ditch No. 14 to W. J. GLEASON CO., Aitkin, 15.45 per cu.yd. Noted Mar. 8.

Minn., Ortonville—(Official)—Ditch—Big Stone County let contract Ditch No. 15 to VAN LOHN & SCHABOT, Graceville, $9425. Noted Mar. 8.

S. D., Madison—(Official)—Ditch—Lake County let contract Ditch No. 7 to N. R. LARSON & CO., Salix, Ia., $8694. Noted Feb. 22.

N. D., Breckenridge—Ditch—Clay County let contract 10-mi. ditch in Kent neighborhood extending through meadows having outlet in coulee that empties into Red River to A. KING, Frazee, and P. EICHMILLER, Vergas, $27,000.

Mont., Hamilton—Canal—Twin Falls Irrigation Dist. let contract Main East Side Canal to LORD & BLAKESLEE, $75,000.

Mo., Independence—(Official)—Drainage—Jackson County, Ft. Osage Drainage Dist., let contract main ditch including 363,000 yd. ditch and 4 laterals, 54,100 yd. to F. M. CRANE CO., Omaha, $.094 per cu.yd. Noted Mar. 8.

Mo., Steffenville—Drainage—Supervs. Steffenville Drainage Dist., Court House, Monticello, let contract excavating to H. K. JOHNSON, Kahoka, $42,700. Noted Mar. 1.

MISCELLANEOUS

Proposed Work

Mass., Revere—(Official)—Road Materials—C. G. Richmond, Supt. Pub. Wks., receiving bids Apr. 3, 55,000 gal. 45% asphaltic oil; 20,000 gal. 65% asphaltic oil; 10,000 gal. non-asphaltic duct laying oil; 10,000 gal. road-asphalt; 15,000 gal. cold tar; 30,000 gal. penetration tar for use during 1917.

N. Y., New York—(Brooklyn)—Park Improvements—Park Bd. plans to improve Prospect Park Plaza at main entrance to park. R. V. Ingersoll, Park Comr.

N. Y., New York—(Brooklyn)—Trap Rock, etc.—L. H. Pounds, Boro. Pres. No. 2, Boro. Hall, receiving bids Apr. 4, furnishing and delivering 3.30 cu.yd. 1½-in. broken trap rock, 1200 cu.yd. trap rock screenings, 2000 cu.yd. sand for use as covering after tar treatment.

N. Y., New York—(Manhattan)—Fire Signal System—J. A. Kingsbury, Comr. Pub. Charities, 10th Floor, Municipal Bldg., receiving bids Apr. 4 furnishing all labor and materials required for the installation of fire signal systems in various groups of buildings. Noted Mar. 1.

N. Y., New York—(Richmond)—Bituminous Material, Etc.—C. D. Van Name, Boro. Pres., Boro Hall, St. George, New Brighton, receiving bids Apr. 3 furnishing and delivering 120,000 gal. bituminous material, 100,000 gal. asphaltic road oil, 100,000 gal. liquid asphalt for road surfacing.

N. Y., Poughkeepsie—(Official)—Road Oil—Bd. Pub. Wks., Municipal Bldg., receiving bids Apr. 5 furnishing and applying asphaltic oil of 45% to 50% asphaltic content to about 300,000 sq.yd. earth and macadam streets during season of 1917. Price to be per sq.yd. treated. E. W. Sylvester, Supt. (See adv. Mar. 22 issue.)

N. J., Ocean City—(Official)—Pavilion—Bd. Comrs. receiving bids Apr. 17, addition to music pavilion. About $20,000. H. A. Morris, City Clk. M. Hand, Jr., City Engr.

Pa., Chester—Elimination Grade Crossings—Baltimore & Ohio Railroad Co. and city will share equally expense of elevating tracks through city. About $1,000,000. B. G. Ladomus,, City Engr. R. N. Begien, Baltimore, Ch. Engr. R.R.

Pa., Duncannon—Subway—Pennsylvania R.R. plans under tracks at Duncannon. A. C. Shand, Broad St. Station, Phila., Ch. Engr.

Pa., Johnstown—Park—City plans 50-acre park in Constable Hollow. J. R. Crissey, City Engr.

Pa., Phila.—Cement, etc.—Bureau Supplies, City Hall, receiving bids Apr. 5, cement, lime, stone, bricks and trap rock during 1917. C. E. Albright, City Engr.

Ky., Fleming—Tipples—Acme By-Products Coal Co. receiving bids Apr. 18, 2 concrete tipples at new plant.

Ohio, Cleveland—Stop Cock Boxes, etc.—City receiving bids Apr. 10, furnishing stop cock boxes and brass fittings for Water Dept. E. Shattuck, 219 City Hall, Pur. Agt.

Ohio, Springfield—Motor Driven Street Sweeping Apparatus—City receiving bids Apr. 5. M. J. Bahin, City Engr.

Mich., Manistique—Park—City to vote Apr. 2, on $12,000 bonds for park improvements.

Wis., Prairie Du Chien—(Official)—Asphalt Binder—City receiving bids Apr. 2, 11,207 ft. W. G. Kirchoffer, 22 North Carroll St., Madison, Engr. W. H. Turbitt, City Clk. Noted Mar. 15.

Ia., Bloomfield—Davis County receiving bids Apr. 4 rein.-con. culverts, bridge planking and vitrified sewer pipe, 20,000 B.M. ft. fir bridge plank 8-in. x 14-in. x 16-ft. x 18-ft.; 20 tons rein. bars; 2000 rein.-con. 15-in. culverts; 1000 18-in. pipe; 500 ft. 24-in. pipe, 200 ft. 36-in. pipe. L. A. Patterson, Bloomfield, County Audr.

Ia., Sioux City—Elimination Grade Crossing—See item under "Streets and Roads."

Minn., Buffalo—Culverts—Wright County receiving bids Apr. 10, furnishing various sizes of corrugated metal culverts until July, 1917. J. A. Berg, Buffalo, County Audr.

Minn., Thief River Falls—Culverts—Pennington County receiving bids Apr. 10, furnishing corrugated metal culverts or sectional concrete culverts for 1917. T. P. Anderson, Thief River Falls, County Audr.

N. D., Carrington—Foster County receiving bids Apr. 6, 24 18-in. x 22-ft. and 36 12-in. x 22-ft. cement or corrugated culverts. W. Wiltschko, Carrington, County Audr.

N. D., Schafer—Culverts—McKenzie County receiving bids Apr. 3 mixed sizes and lengths of steel and iron culverts. O. P. Benson, Schafer, County Audr.

N. D., Washburn—Culverts—McLean County receiving bids Apr. 3, metal culverts, 60 15-in. culverts, 22 ft. long; 60 18-in. culverts, 22 ft. long; 10 24-in. culverts, 22 ft. long. E. C. Stocker, Washburn, County Engr.

Tex., Corsicana—Monument—Corsicana Volunteer Fire Dept. receiving bids Apr. 25 erection and completion "Firemens' Monument." P. Mayer, 1st Asst. Chief.

Ore., Newport—Harbor Improvements—[illegible] County plans election to vote on $500,00[illegible] to improve Yaquina Bay. Address Coun[illegible] Toledo.

Bids in and Contracts Awarded

N. Y., New York—(Manhattan)—(Official)—Special Work—Pub. Ser. Comn., 120 Broadway, received low bid supply of special work [illegible] No. 11, from Bethlehem Steel Products Co., 111 Broadway, $34,136.

N. Y., New York—(Manhattan)—Special [illegible]—Pub. Ser. Comn., 120 Broadway, received bids supply of special work, Order No. 12, from W. Wharton, Jr. & Co., 30 Church St., $[illegible]; Ramapo Iron Works, 30 Church St., $[illegible]; Bethlehem Steel Products Co., 111 Broadway, $40,343. These are unofficial totals.

N. Y., New York—(Manhattan)—(Official)—Trailers, etc.—Dept. St. Cleaning, Municipal Bldg., received bids furnishing and delivering (a) [illegible] trailers, (b) parts, from C. Hvass & Co., [illegible] East 18th St., (a) $37,644, (b) $2510; Troy Wagon Works, 1876 Broadway, (a) $54,150, (b) $2450; Concord Construction Co., 476 Seneca Ave., Brooklyn, (a) $51,300, (b) $3228.

N. J., Atlantic Highlands—Lagoon—Council let contract at mouth Many Minds Creek to form harbor for pleasure boats to J. HOWLAND, Sea-bright, about $18,000.

N. J., South Orange—(Official)—Road Oil—Received low bids (a) non-asphalt, (b) asphalt, (c) Tarvia "B" from Standard Oil Co., 31 Clinton St., Newark, (a) 8.99c., (b) 6.24c.; Headley Good Roads Co., 301 South 30th St., Phila., (a) 0.0648, (b) 0.0699; W. G. Logan & Hathaway, 9 Clinton St., Newark, (a) 8.45c., (b) 6.88c.; Barrett & Co., 86 Elizabeth Ave., Elizabeth, (c) 0.07c.; Barber Asphalt Paving Co., Maurer, (c) 0.075c.; E. H. Petz Construction Co., 15 William St., East Orange, (c) 0.0875c. Noted Mar. 8.

N. J., South Orange—(Official)—Stone—Town Comn. let contract to R. KUNAN. Noted Mar. 8.

Pa., Phila.—(Official)—Parks—Improvements—Dept. Pub. Wks. let contract laying or repairing Neuchatel or asphalt pavements and curbs, fountain basins, steps, posts and copings in parks and squares in city during 1917 to H. F. MARKLAND, 612 Lincoln Bldg. Noted Mar. 8.

Ky., Louisville—(Official)—Road Oil—City received bids Mar. 19 from Standard Oil Co. of Kentucky, 424-430 West Bloom St., 0.055c. per gal.; Tyler & Breslin, 0.0515c.; Barrett Co., 86 Elizabeth Ave., Elizabeth, N. J., tar, 0.075c.; American Tar Products Co., tar, 0.070c. Noted Mar. 15.

Minn., St. Paul—Crushed Stone, etc.—H. W. Austin, City Pur. Agt., City Hall, received low bid 500 cu.yd. crushed stone; 200 cu.yd. brick mortar sand; 275 cu.yd. concrete sand for Phalen Park Beach from St. Paul Crushed Stone Co., Stewart and Victoria St. Noted Mar. 8.

Wash., Tacoma—Rock, Etc.—(Official)—Inter-County River Impvt. Assn., Court House, rejected bids Mar. 8, 5000 tons rock and 5000 cords brush for use in river improvements. W. J. Roberts, Ch. Engr. Noted Mar. 1.

Calif., Long Beach—(Official)—Seawall—City let contract between Chestnut Pl. and Golden Ave. to H. W. SCHLEUTER, about $54,477. Noted Mar. 8.

Calif., San Francisco—Pier—State Bd. Harbor Comrs. let contract Pier 31, Sansome St., to HEALY-TIBBITS CONSTRUCTION CO., Main and Market St., $293,600.

BUILDINGS

Proposed Work

Other items relative to Building Construction will be found under the following headings: "Industrial Works," "Federal Government Work" and "Miscellaneous."

N. H., Portsmouth—Sinclair Inn., 241 Middle St., plans 3-story, 45 x 75-ft. addition in fall. A. B. Horton, Prop. R. Colt, 85 Water St., Boston, Arch.

Mass., Adams—Hotel—Town and City of North Adams making plans brick. Parker, Thomas & Rice, 110 State St., Boston, Arch.

Mass., Fall River—Theater—A. A. Spitz, 621 Cæsar Misch Bldg., making plans 110 x 140-ft. and 25 x 100-ft. About $200,000.

Mass., Holyoke—Club—Holyoke Boys' Club plans on Race St.

Ct., Bridgeport—City soon receives bids 3-story brick and steel welfare building, Washington and Madison Ave. L. Asham, Arch.

Ct., Hartford—Fire House—City plans 4-story brick and concrete on Pearl St.

Ct., Hartford—Office—Phœnix Mutual Insurance Co. plans, Elm and Clinton St.

Ct., New London—Store and Office—J. T. Sexton plans to build 3-story, brick, on State St.

Ct., Stratford—School—Bd. Education made plans. R. G. Howland, M. D., Chn. School Bd. Frank Irving Cooper Corp., 33 Cornhill, Boston, Arch.

Ct., Waterbury—Store and Office—G. L. Lilley Co. making plans, West Main and Leavenworth St. W. E. Griggs, Lily Bldg., Arch.

N. Y., Buffalo—Bank—Citizens Commercial Trust Co., Ellicott Sq., making plans. Mann & Cook, Dunn Bldg., Arch.

N. Y., Cortland—Bank and Office—Cortland Savings Bank, 111 Main St., making plans 4-story. About $100,000. Holmes & Winslow, 103 Park Ave., New York, Arch.

Buildings (Continued)

N. Y., Lake Placid—Schools—Bd. Education making plans 3 schools. About $155,000. M. D. Weaver, Pres. Pember & Campaigne, 24 James St., Albany, Arch.

N. Y., New York—(Brooklyn)—Office—Court & Remsen Co., Inc., making plans 21-story, granite, limestone and face brick, Court and Remsen Sts. Starrett & Van Vleck, 8 West 40th St., Manhattan, Arch.

N. Y., New York—(Manhattan)—Hotel—The 48th St. Co. plans 19-story, 100 x 100-ft. H. Claman, 241 West 43d St., Pres. Gronenberg & Leuchtag, 303 5th Ave., Arch

N. Y., Sherill—School—Bd. Education plans. About $40,000.

N. J., Atlantic City—Hotel—Syndicate of Atlantic City and Philadelphia men plan on Illinois Ave. About $3,000,000. H. Trumbauer, Land Title Bldg., Phila., Arch.

N. J., Atlantic City—Hotel—Meadowbrook Hotel Co. plans. About $2,000,000.

N. J., Atlantic City—Hotel—Atlantic City Hotel Corp., recently incorporated, made plans 24-story, Delaware and States Ave. E. H. Culbert, J. L. Young, and others, interested.

N. J., Newark—Bank—Springfield Ave. Trust Co. plans, Springfield Ave. and 10th St. E. E. Gnichtel, Pres.

N. J., Perth Amboy—School—Bd. Education plans, Hall Ave. and Buena Vista Pl.

N. J., Sussex—Lehigh & New England R.R. plans passenger and freight station. W. Full, South Bethelehem, Pa., Ch. Engr.

N. J., Trenton—Dormitory—T. W. Synnott, Chn. State Bd. Education, State House, receiving bids Apr. 7, dormitory at School for Deaf.

N. J., Trenton—Store—Goldberg Dept. Store making plans 4-story brick and steel addition. About $75,000. Klemann & Fowler, 1st National Bank Bldg., Trenton, Arch.

Pa., Phila.—Auditorium—City made plans, Hamilton and 22d St. and Pkwy. J. T. Windrim, Commonwealth Bldg., Phila., Arch.

Pa., Phila.—Store—J. B. Gillies making plans 3-story, 68 x 117-ft., brick and stone, 2204-12 North Broad St. F. E. Hahn, Arch.

Pa., Pittsburgh—Church, School, Parish House and Convent—St. Peter's Congregation made plans. About $150,000.

Pa., Tarentum—School—St. Josephs Congregation plans. About $40,000. J. A. Huth, Chn.

Del., Wilmington—Armory—State Legislature appropriated $50,000 toward cost of new armory. About $250,000.

Va., Newport News—Hotel—Old Dominion Land Co., care of W. Livesey, 23d St. and West Ave., receiving bids about Apr. 15, 1-story addition. About $50,000. Ferguson, Calrow & Wrenn, Virginia Bank Bldg., Norfolk, Arch.

W. Va., Ashland—Hotel—A. Salisbury, Huntington, and J. Kobs, plan 7-story.

W. Va., Charleston—Court House—Kanawha County Comrs. receiving bids Apr. 2 addition. G. Copenhaver, Pres. H. R. Warne, Arch.

W. Va., Wheeling—Auditorium and Market—Bd. of Trade plans. About $150,000.

N. C., Henderson—Bank—Henderson First National Bank making plans 4-story, 45 x 100-ft. Milburn, Heister & Co., Union Savings Bank Bldg., Wash., D. C., Arch.

Ga., Macon—Temple—Masonic Lodge plans addition. About $75,000.

Ga., Savannah—Home—A. F. & A. M. of Georgia making plans home for orphans. About $50,000. F. O. Miller, Ft. Valley, Grand Master.

Ga., Savannah—Store—J. P. Copps making plans 2-story, Broughton and Drayton St. About $50,000.

Fla., Miami—Club—Elks Lodge soon lets contract. About $100,000.

Ala., Birmingham—Church—Norwood Methodist Congregation plan. About $50,000. J. A. Duncan, Pastor.

Ala., Birmingham—Exchange—American Telephone and Telegraph Co. plans. G. R. Knox, Mgr.

Ala., Mobile—Schools—Mobile County Bd. Education making plans. About $150,000. G. B. Rodgers, Van Antwerp Bldg., Arch.

Miss., Belzoni—School—City voted $50,000 bonds to build school.

Tenn., Kingsport—Station—Carolina, Clinchfield & Ohio Ry. plans 1-story, 40 x 160-ft. brick and concrete. About $50,000. O. K. Morgan, Johnson City, Engr. in Charge.

Tenn., Knoxville—Hotel—Whittle Springs Co., Inc., receiving bids in August or September 50 x 300-ft., frame and brick. About $40,000. O. F. White, Pres. R. F. Graf & Sons, Knoxville, Arch.

Tenn., Knoxville—State Legislature appropriated $100,000 for new buildings and improvements at University of Tennessee.

Tenn., Memphis—Auditorium—City plans election to vote on $700,000 bond issue for auditorium. C. C. Pashby, City Clk.

Tenn., Nashville—Y. M. C. A. plans new building. About $75,000.

Tenn., Trenton—High School—City plans election to vote on $50,000 bonds for high school.

Ky., Louisville—Auditorium—City made plans About $250,000. D. X. Murphy & Bros., Louisville Trust Bldg., Arch.

Ky., Newport—Theater, Store and Office—Citizens Mutual Auditorium and Theater Co. plans 2-story, 87 x 190-ft. About $125,000. C. C. & E. A. Weber, Citizens' Bank Bldg., Cincinnati, Arch.

Ohio, Blacklick—School—Bd. Education, Jefferson Township receiving bids Apr. 7. C. R. Kidd, Pres. F. S. Rusk, 145 North High St., Columbus, Arch.

Ohio, Canton—Church—Calvery Presbyterian Congregation made plans, Shorb Ave. and Wendell Pl. About $40,000. Address H. B. Vail.

Ohio, Lima—Store and Office—E. G. Blume soon receives bids 5-story, 50 x 150-ft. brick, steel and concrete. About $100,000. A. Da Curtins, Opera House Blk., Arch.

Ohio, Lorain—Temple—Lorain Masonic Lodge plans on Broadway. About $100,000.

Ohio, Lorain—Home—Order of Moose plans.

Ohio, Newark—Academy, Convent and Gymnasium—St. Francis de Sales Congregation receiving bids Apr. 10. A. E. Wilbert, Chn. Bldg. Com. Howard & Merriman, 8 East Broad St., Columbus, Arch.

Ohio, St. Paris—School—Bd. Education to sell $75,000 bonds Mar. 30 to build school. J. Lewis, Clk. C. Sheets, Columbus, Engr.

Ohio, Springfield—Business and Office—R. Q. King making plans 6-story. R. C. Gotwald, Gotwald Bldg., Arch.

Ohio, Troy—School—Bd. Education Bethlehem Township, Rural School Dist., receiving bids Apr. 2. C. W. Fry, R. F. D., Tippecanoe City, Clk. G. P. Walker & Co., 1300 Conver Bldg., Dayton, Arch.

Ind., Indianapolis—Office and Freight House—Cincinnati, Indianapolis & Western Railroad Co. plans 4-story, 45 x 189-ft. on Virginia St. About $350,000. H. F. Passel, Indianapolis, Ch. Engr.

Ind., Terre Haute—Church—United Brethren Congregation plans rebuilding church recently destroyed by fire. L. O. Blake, Pastor.

Ind., Vincennes—Hospital—J. I. Muentzer, Audr. Knox County, receiving bids Apr. 4, addition.

Mich., Cadillac—Church—Methodist Episcopal Congregation plans. About $50,000.

Mich., Detroit—Prison—City plans. About $1,500,000. R. Lindsay, City Clk.

Ill., Champaign—Dormatory—E. L. Melton, 602 John St., plans 10-story, 116 x 120-ft. About $300,000.

Ill., Chicago—Club—Off The Street Club of Chicago, 1346 West Van Buren St., plans. About $45,000. P. H. Murphy, Pres.

Ill., Chicago—Hotel—H. W. Sisson, 7 South Dearborn St., making plans 11-story, 104 x 170-ft. About $800,000. H. R. Wilson & Co., 11 South La Salle St., Arch.

Ill., Chicago—Hotel—American Cities Hotel Corp. receiving bids Apr. 20, 10-story, 150 x 176-ft. About $900,000. W. W. Ahlschlager, 111 West Washington St., Arch.

Ill., Davenport—Schools—City voted $450,000 bonds to build schools.

Ill., Decatur—School—Bd. Education made plans Lincoln School. About $63,700. Brooks & Bramhall, New Decatur National Bank Bldg., Arch.

Ill., Pana—Church—Presbyterian Congregation made plans. About $40,000. F. A. Ferris, 408 South Kitchell Ave., Pastor. Liese & Ludwick, Dale Bldg., Dansville, Arch.

Ill., Quincy—Orphanage—St. Aloysious Society making plans. About $50,000.

Ill., Waukegan—Bank and Office—Security Savings Bank, 214 Washington St., receiving bids about Apr. 1, 3-story, 40 x 70-ft. About $50,000. T. H. Durst, 319 Hickory St., Pres. E. J. Casse, care of A. H. Andrews Co., Dir. Engr.

Wis., Kenosha—Hotel—Maxine-Carleton Hotel Co. plans, Main and South St. About $250,000.

Wis., Waukesha—High School—City voted $175,000 bonds to build high school.

Ia., Beech—School—Bd. Education receiving bids Apr. 5. J. A. Green, Secy.

Ia., Centerville—High School—Bd. Education soon lets contract. About $150,000.

Ia., Iowa City—School—City voted $250,000 bonds to build school.

Ia., Seneca—School—Bd. Education receiving bids Apr. 6. P. Thorson, Secy. Broaten & Mincey, Mason City, Arch.

Ia., Sergeant Bluff—School—Bd. Education Consolidated Independent School Dist. receiving bids Apr. 2. H. M. Michaelson, Secy. W. L. Steele, 502 United Bank Bldg., Sioux City, Arch.

Minn., Annandale—School—Bd. Education receiving bids in April 2-story, 75 x 144-ft. About $50,000. N. C. Smith, Clk. C. H. Parsons, 661 Phoenix Bldg., Minneapolis, Arch.

Minn., Beltrami—Bd. Education Consolidated School Dist. No. 53, receiving bids Apr. 5. E. W. Johnson, Clk. E. F. Bromhall, 710 Alworth Bldg., Duluth, Arch.

Minn., Bemidji—School—City defeated $50,000 bonds to build school.

Minn., Clara City—School—Bd. Education receiving bids Apr. 6, 2-story, 62 x 109-ft. Alban & Prins, 347 Endicott Bldg., St. Paul, Arch.

Minn., Minneapolis—Church—Macalester Presbyterian Congregation receiving bids about Apr. 1. A. Macalester, Chn. Bldg. Com. T. G. Holyoke, 649 Endicott Bldg., Arch.

Minn., Ortonville—School—Bd. Education Dist. No. 62, Big Stone County, receiving bids Apr. 14. I. Kvatum, Pres.

Minn., St. Paul—School—St. Paul School for Girls making plans 2- to 4-story. About $150,000 C. H. Johnston, 715 Capital Bank Bldg., Arch.

Minn., St. Peter—Gymnasium—Gustavus Adolphus College plans. About $50,000.

Minn., Staples—Church—Sacred Heart Congregation receiving bids Apr. 9, brick and stone F. Zitur, Pastor.

Kan., Clay Center—Bank—Peoples National Bank receiving bids Mar. 31 2-story, 40 x 80-ft. brick and stone. About $40,000. F. B. Fullington, Pres.

Kan., Clyde—School—Bd. Education plans 2-story, brick and stone. About $45,000. L. Schmidt, 121 North Market St., Wichita, Arch. Noted Dec. 7.

Kan., Great Bend—Court House—Barton County plans 3-story, 95 x 120-ft., brick, stone and rein. con. About $150,000. W. E. Hulse & Co., Hutchinson, Arch. Noted Mar. 8.

Kan., Lyons—Hospital—Lyons County Hospital Assn. making plans 2-story, 35 x 85-ft., brick and cut stone. L. C. Needham, Secy. L. Schmidt, Wichita, Arch.

Kan., Parsons—City Hall and Auditorium—City election Apr. 3 to vote on $150,000 bonds to build city hall and auditorium.

Kan., Wichita—Theater and Store—J. H. Cooper making plans 2-story 50 x 140-ft. terra cotta, steel and brick. About $75,000. C. Boller & Bros., 7 Gayety Theater Bldg., Kansas City, Mo., Arch.

Neb., North Bend—Station—Union Pacific R.R. plans. R. L. Huntley, Omaha, Ch. Engr.

Neb., Omaha—Schools—Bd. Education plans election to vote on $1,000,000 bonds to build schools.

Neb., Omaha—Church—St. Mary's Congregational Church plans. O. T. Eastman, Chn. Bldg. Com.

Neb., Scottsbluff—Hotel—W. H. Ostenberg plans 5-story, brick and stone. About $100,000.

Neb., Sterling—School—City voted $50,000 bonds to build school.

S. D., Huron—City Hall—City voted $80,000 bonds to build city hall.

S. D., Huron—High School—City voted $100,000 bonds to build addition to high school.

S. D., Parker—Court House—Tripp County plans to vote on $65,000 bonds to build court house. V. B. Clikeman, Winner, County Audr.

Wyo., Casper—City Hall—City plans to vote on bonds to build city hall.

Mont., Billings—L. Mains and associates plan 5-story business block on 1st Ave. and 27th St.

Mo., College Springs—School—Bd. Education retained Trunk & Gordon, Arch., St. Joseph, to make plans. About $65,000.

Mo., Kansas City—Exchange—Southwestern Bell Telephone Co., Gates Bldg., plans 14-story, 100 x 126-ft., 11th and McGee St. H. F. Holt, 315 East 10th St., and I. R. Timlin, Boatman's Bank Bldg., St. Louis, Arch.

Mo., St. Joseph—Hotel—Alexandria Investment Co., Kansas City, making plans 2-story. About $250,000. Eckel & Aldrich, 1102 Corby Forsee Bldg., Arch.

Mo., St. Louis—Club, Office and Store—University Club plans 13-story, Washington and Grand Ave.

Mo., St. Louis—Office—G. W. Brown plans 9-story, 17th and Locust St.

Mo., Trenton—School—Bd. Education making plans 3-story. About $85,000. R. H. Henley, Pres. Sanneman & Goold, 519 Reserve Bank Bldg., Kansas City, Arch.

Ark., Pine Bluff—High School—Bd. Education receiving bids Apr. 7, rein.-con. H. B. Strange, Peoples Bank Bldg., Secy.

Ark., Pine Bluff—Hotel—W. T. Hill plans, 4th Ave. and Chestnut St.

Ark., Russellville—Hospital—R. L. Smith and L. Gardner M. D., made plans 3-story, brick.

Tex., Austin—Library—City plans to vote on $100,000 bonds to build library.

Tex., Beaumont—St. Louis, Brownsville & Mexico Ry. plans depot and terminals. About $75,000. C. J. Kirkpatrick, Kingsville, Div. Engr.

Tex., Crockett—School—City plans $75,000 bond issue to build school.

Tex., Dallas—Club—Dallas Club plans 8- or 10-story. About $500,000. W. E. Griener, Pres.

Tex., Dallas—Office—Southern Life Insurance Co. plans 10-story, 75 x 100-ft., Commerce and Browder St. About $200,000. Lang & Witchell, Southwestern Life Bldg., Arch.

Buildings (Continued)

Tex., Ft. Worth—Church—First Presbyterian Congregation plans. About $45,000. A. E. Holt, Pastor.

Tex., San Antonio—Hotel—L. Kaufman making plans 8-story, 38 x 87-ft. About $100,000. E. P. Behles, Hicks Bldg., Arch.

Tex., Victoria—High School—Bd. Education, Independent School Dist. made plans 3-story, brick. About $85,000. C. H. Page & Bros., Austin, Arch. Noted Feb. 8.

Tex., Waco—Church—German Baptist Congregation plans, 9th and Clay St.

Tex., Waxahachie—Bank and Office—Waxahachie Bank plans 5-story.

Okla., Ardmore—Church—Broadway Methodist Congregation plans. About $75,000.

Okla., Drumright—Hotel—Stephenson, Odell, Achterman & Hulm made plans 4-story. About $60,000. W. Griffith & Son, Sapulpa, Arch.

Okla., Enid—High School—Bd. Education plans addition. About $50,000.

Okla., Norman—Buildings—University of Oklahoma plans Geology Building, $100,000; wing to library, $75,000; auditorium, $150,000.

Okla., Tulsa—Church—Christian Church Congregation plans 100 x 140 ft. About $75,000. J. W. Darby, 322 South Nogales St., Pastor.

Okla., Tulsa—Office—R. M. McFarlin plans 16-story, 4th and Main St. About $800,000.

Okla., Tulsa—Theater—W. M. Smith making plans 80 x 150-ft. G. Winkler, 414 Palace Bldg., Arch.

Colo., Trinidad—School—City election May 7 to vote on $100,000 bonds to build school. F. W. Jones, Secy.

N. M., Roswell—Schools—Chaves County, School Dist. No. 1, election Apr. 3d to vote on $100,000 bonds to build schools.

Utah, Bingham—Schools—Bd. Education Jordan School Dist. plans to vote on $150,000 bond issue to build schools.

Utah, Bingham—Schools—Bd. Education Highland Boy Dist. plans $75,000 bond issue to build schools.

Utah, Salt Lake City—Church—St. Paul Congregation making plans. Ware & Treganza, Utah Savings Trust Bldg., Arch.

Ariz., Phoenix—Hotel—Southern Pacific R.R. plans at Roosevelt Lake. About $250,000. W. Hood, San Francisco, Ch. Engr.

Ariz., Tucson—Hotel—M. T. Grier made plans 8-story, 165 x 169-ft. About $400,000. J. Parkinson, Title Insurance Bldg., Los Angeles, Arch.

Wash., North Yakima—Business—F. Chandler and A. R. Thiesen plan on 3d St. About $75,000.

Wash., Olga—School—Frank Moran, Rolling Bay, plans Moran School for Boys. About $50,000.

Wash., Tacoma—Hotel—C. A. Murray made plans 2- and 3-story on Lake Stellacoom. About $150,000. Heath & Gove, National Realty Bldg., Arch.

Ore., Corvallis—Library—Oregon Agricultural College receiving bids Apr. 1, 2-story, rein.-con., brick and stone. About $100,000. J. V. Bennes, Chamber of Commerce Bldg., Portland, Arch.

Calif., Long Beach—City Hall and Jail—City plans. About $300,000.

Calif., Stockton—Home—San Joaquin County receiving bids Apr. 3. E. D. Graham, Stockton, County Clk.

Que., Montreal—School—St. Jean Baptiste School Commission plans, Berri and Chateaubriand Ave. About $275,000.

Ont., Brampton—High School—Bd. Education plans. About $60,000.

Bids In and Contracts Awarded

Mass., Chicopee—High School—Bd. Education received low bids from G. T. Kelly, Yonkers, N. Y., $325,800; Tracy Bros., Waterbury, Ct., $348,000; Hoton & Hemenway, Boston, $376,670.

Mass., Springfield—Store—Forbes & Wallace, Vernon St., let contract 3-story addition to E. J. PINNEY, 264 Main St.

Ct., Hartford—High School—Bd. Education let contract 3-story addition to H. WALES LINES CO., 134 State St., Meriden. About $250,000. Noted Feb. 22.

N. Y., Kings Park—Home—State Hospital Comn., Albany, received low bids from McKeown Construction Co., 103 Park Ave., Manhattan, $71,379; C. Schneider & Son, 1251 De Kalb Ave., Brooklyn, $72,460; J. McArthur, 22 Ormand Pl., Brooklyn, $73,000.

N. Y., New York—(Brooklyn)—Uneeda Construction Co., 299 Broadway, Manhattan, plans 4-story loft building on Liberty Ave. by day labor. About $260,000. J. Harrison, 63 Park Row, New York, Arch., making plans.

N. Y., New York—(Manhattan)—Bank—Knickerbocker Club, 2 East 62d St., let contract 4-story to be leased by Sherman National Bank to GILLIES-CAMPBELL CO., 101 Park Ave.

Pa., Chester—Lodge—Chester Nest of Owls let contract, Sproul and 9th St., to H. H. JACKSON, Chester, about $40,000.

Pa., Greenville—High School—Bd. Education let contract Penn High School to KRATT & AGNEW, Lorain, Ohio, $164,637.

Pa., Phila.—Exchange—Bell Telephone Co. contract 4-story, 57th and Chestnut St., to H. W. & LEIGHTON.

Pa., Phila.—Church—West Side Presbyterian Church let contract, Pulaski and Winona Ave., to F. ELDRIDGE & SON, about $50,000.

Pa., West Chester—School—Bd. Education received low bids from Metzger & Fisher, Phila., $90,717.

Pa., York—School—Bd. Education let contract Kurtz Ave. and Newberry St., to G. W. GILBERT, $46,085.

Wash., D. C., Store and Office—H. K. Willard, Pasadena, Calif., let contract 4-story, 41 x 50 ft., to H. F. BORYER, 1300 F St., N. W., Wash., $50,000.

W. Va., Charleston—Bank and Office—Kanawha Banking and Trust Co. let contract 9-story to G. B. WILLS CO., 101 Park Ave., New York. Noted Sept. 21.

Ga., Augusta—Store, Office and Fraternal—Masonic Temple Building Co. let contract to H. J. CARR & CO., Atlanta, $141,000.

La., Alexandria—Auditorium, etc.—City let contract to J. D. PRIDGEN, Crichton.

La., New Orleans—Home—New Orleans Lodge No. 30, B. P. O. Elks let contract to J. THATCHER & SON, Brooklyn, N. Y., $288,285. Noted Feb. 15.

Ohio, Ashley—School—Bd. Education let contract to TAYLOR & LINN, Zanesville. About $42,000. Noted Feb. 22.

Ohio, Dayton—Club—Engineers' Club, East 1st St., let contract new building, Monument Ave. and Jefferson St., to E. A. DEEDS and C. F. KETTERING. About $250,000.

Wis., Kenosha—Club—Kenosha Lodge of Elks let contract to IMMEL CONSTRUCTION CO., Fond du Lac, $93,907.

Ia., Oskaloosa—Dormitory—Penn College let contract to REED-McDONALD-BREWSTER, INC., Minneapolis, $81,944.

Ia., Waukee—School—Bd. Education Consolidated School Dist. let contract to WESTERN CONSTRUCTION CO., Iowa City, about $50,000. Noted Feb. 22.

Mont., Butte—Hotel—Ben Bank Realty Co. let contract 3-story to MOWARD & CANNON, $50,000.

Mo., Kansas City—Theater and Business—J. C. Wirthman, 18th St. and Troost Ave., let contract to J. R. VANSANT CONSTRUCTION CO., 314 Dwight Bldg., about $170,000. Noted Feb. 8.

Okla., Woodward—City Hall—City let contract to R. M. CRISSMAN, Oklahoma City.

"The Bradford-Ackermann Corporation, recently formed by A. H. Ackermann and C. C. Bradford, with offices in the 42nd Street Building, New York City, announce that they have concluded arrangements with Ashton, Laird & Company, for the sole selling rights of their "Astra" high-temperature gas apparatus and oxygen-welding appliances, manufactured from the designs and patents of E. Raven Rosen-Baum, the well known consulting engineer on high-temperature gases.

In addition to the extensive line of the various oxy-acetylene-welding appliances, of proven merit and superiority, there will be marketed a new and standardized line of oxy-illuminating gas apparatus exclusively manufactured by this company. In this process either natural or artificial illuminating gas, direct from the town supply, is substituted as a supporting gas in connection with oxygen, and recommended for economy and efficiency, on a number of classes of work where its specific temperatures are especially adapted.

These new appliances produce a proper neutral flame and permit an extraordinary simplicity of operation. The process has proven to be of considerable technical value on a variety of work and is already domineering various fields, such as lead burning, etc.

At a recent meeting of the stockholders of the **Harrison Brothers and Company, Inc., of Philadelphia,** the stockholders agreed to accept the offer made by the Du Pont Company of Wilmington, Delaware and the paint firm became one of the Du Pont's subsidiaries.

The sale marks the union of two of the oldest and best-known manufacturing firms in the country. The Harrisons date from 1793 and the Du Ponts from 1802. The transfer to new owners will bring no radical change in the conduct of the paint business. This will be continued by the new owners and the products hitherto turned out by the Harrisons will continue to be made by virtually the same organization.

The present Harrison plant on Gray's Ferry Road, on the Schuylkill River, covers 40 acres, on which there are 80 buildings. Notable among these is a model lead plant with annual capacity of 10,000 tons. The demand for chemicals since the war has caused the company to organize the Mantua Chemical Company whose works are at Paulsboro, New Jersey, on a tract of 250 acres. The company also owns a plant at Sixth and Jackson Streets, Camden, New Jersey; and a pyrites mine in Virginia.

The price paid by the Du Ponts is $5,700,000 in cash, the purchasers assuming all the outstanding obligations of the company.

This provides sufficient funds to pay to the preferred stockholders par and accrued dividends and to the common stockholders about $200 per share after payment of the commissions and legal and other expenses incurred in the carrying out of the negotiations and the liquidation of the company.

The business will be conducted by a new Pennsylvania corporation to be known as "Harrisons, Inc.," a charter for which has been applied for. The incorporators are Lammot du Pont, Dr. Charles L. Reese, and Charles A. Meade, of the Du Pont Company; A. R. Glancy and Wm. Richter, Secretary of the Harrison Company.

George L. Hammons, Inc., Engineers' Supplies, Factory Equipment, etc., has opened an office and sales room at 627 Washington Blvd., Chicago, Ill. The company will handle a line of specialties for the engineering trade an dact as special representatives of the U. S. Asbestos Co. in Chicago.

The Navy Department signalized the past week by the largest awards for war vessels ever made by the United States Government at one time, all proposals for such vessels outstanding being awarded during the week. The battle cruisers, four in number, were awarded as follows, all on the basis of actual cost plus ten per cent. profit, this actual cost to be passed upon by a board of Naval Officers appointed by the Secretary: Two to the Newport News Shipbuilding and Dry Dock Co., one to the Fore River Shipbuilding Co., and one to the New York Shipbuilding Co., at a cost not to exceed $19,000,000 each. It is the intention of the Department to construct a fifth at the Philadelphia Navy Yard after the expenditure of $6,000,000 for construction of shipbuilding ways, etc. Six scout cruisers were awarded as follows: Two to the William Cramp Ship and Engine Building Co., at $5,950,000 each, two to Union Iron Works, San Francisco, Calif., at $6,000,000 each, two to the Seattle Dry Dock and Construction Co., at $5,975,000 each. On Mar. 24, bids were received on torpedo boat destroyers, all at cost plus ten per cent., and awards were made the same day of ten to the Union Iron Works, eight to Fore River Shipbuilding Co., and six to William Cramp & Sons Ship and Engine Building Co. On Mar. 21, preliminary bids were received on the 110-ft. submarine patrol boats or chasers of which the Government expects to purchase 200. Prices were not made public as final bids will be received on these boats on Mar. 31.

No very large purchases of supplies were made, except for 500,000 lb. of cotton waste, from the Massasoit Mfg. Co., at $145,998. The balance of the purchases were routine.

The Navy Department is asking for bids Apr. 4 for a large quantity of steel for the pontoon of the floating crane at Mare Island, as follows: 1550 lb. openhearth steel rounds, 1,370,000 lb. openhearth steel plates, 328,000 lb. openhearth steel angles and 358,000 lb. steel channels.

The Bureau of Ordnance, War Department, opens bids Apr. 3 at Washington and Valparaiso, Chile, for 81,000,000 lb. of sodium nitrate for powder manufacture, being the largest purchase of this material ever made by the Government.

The Bureau of Ordnance, Navy Department, will open bids Apr. 4 for armor-piercing projectiles, 8100 16-in. and 2000 14-in., and on Apr. 11, for common shell, 10,800 6-in., 76,200 5 in., 97,000 4-in., 90,000 6-pounder and 1,170,000 1-pounder, as well as for a number of target projectiles.

Bacharach Industrial Instrument Co. has removed its business from 14 Wood St. to 422 1st Ave., Pittsburgh, Pa.

Edison Portland Cement Co., 1133 Broadway, New York, N. Y., has removed its general offices to 8 West 40th St., New York.

W. A. Freret, Contracting Engr., has opened an office at Windsor, Colo., and would like to receive catalogues of contractors' equipment.

Pittsburgh-Des Moines Steel Co., Curry Bldg., Pittsburgh, Pa., has opened an office at 1260 First National Bank Bldg., Chicago, Ill., in charge of M. Whitacre.

Tata Iron and Steel Co. located near Calcutta, India, recently awarded the contract for a modern steel plant to the Pennsylvania Engineering Co., Philadelphia, Pa.

SPECIAL OPPORTUNITIES SECTION

Contracts To Be Let

Bids received until Apr. 10, 1917.

State Canal Improvements

STATE OF NEW YORK.
OFFICE OF SUPERINTENDENT OF PUBLIC WORKS.
Albany, March 7th, 1917.

Sealed proposals will be received by the undersigned at his office in the Capitol at Albany, N. Y., until twelve o'clock noon of Tuesday, April 10th, 1917, at which place and hour they will be publicly opened and read, for improving the New York State canals pursuant to the provisions of Chapter 147 of the Laws of 1903, and of the acts amendatory thereof and supplementary thereto, and Chapter 570 of the Laws of 1915, as follows:

CONTRACT NO. 138.
Erie Canal—Section 9.

For constructing a movable dam, bulkheads, retaining walls and incidental work, at Rochester.

Sheets 1 to 52, inclusive.

Plans may be seen and detailed specifications, engineer's estimate of quantities, proposal blanks, form of contract and bonds required and other information for proposers may be had at the office of the Superintendent of Public Works at Albany, N. Y., at the office of the Assistant Superintendent of Public Works for the Middle Division at Syracuse, N. Y., at the office of the Assistant Superintendent of Public Works for the Western Division at Rochester, N. Y., and at the canal office, Spaulding's Exchange, Buffalo, N. Y.

Copies of detailed plans of drawings may be obtained from the State Engineer and Surveyor at Albany, N. Y., upon payment to him of the cost of producing them.

Monthly estimates will be paid of ninety per centum (90 per cent.) of the work done at the contract price. Every proposal for said work must be accompanied by a money deposit in the form of a draft or certified check upon some good banking institution in the City of Albany or New York, issued by a national or state bank in good credit within the state and payable at sight to the Superintendent of Public Works for five per centum (5 per cent.) of the amount of the proposal.

The person whose proposal shall be accepted will be required to execute a contract and furnish bonds within ten days from the date of notice of award delivered to him or them in person or mailed to the address given in the proposal.

Upon execution of the contract and approval of bonds, the certified check or draft will be returned to the proposer unless the same shall have been presented for collection prior to such time, in which case the amount of the deposit will be refunded by the Superintendent of Public Works.

The deposits of bidders other than the one to whom the award of contract shall be made will be returned immediately after the award has been made.

The bond required for the faithful performance of each contract shall be in such sum as shall be fixed by the Superintendent of Public Works, which sum shall not be less than twenty per centum (20 per cent.) of the estimated cost of the work according to the contract price, and an additional bond, known as the labor bond, in the sum of ten per centum (10 per cent.) of the amount of the estimated cost of the work according to the contract price, will be required as security that the contractor will pay in full at least once in each month all laborers employed by him upon the work specified to be done in the contract.

In the event that more than one surety company is offered as surety on said bonds co-insurance only will be accepted. Each proposal must be addressed to the Superintendent of Public Works, Albany, N. Y., and must be endorsed on the envelope with the name of the construction for which the proposal is made.

Award, if possible, will be made to the person or persons whose proposal shall be lowest in cost to the State for doing the work, and which shall comply with all provisions required to render it formal. Before any award shall be made the lowest bidder will be required to satisfy the Superintendent of Public Works of his ability to provide suitable equipment and materials for the proper performance of the work.

The right is reserved to reject all proposals and readvertise and award the contract in the regular manner if, in the judgment of the undersigned, the interests of the state will be enhanced thereby.

W. W. WOTHERSPOON,
Superintendent of Public Works.

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PROPOSALS FOR TIMBER—U. S. Engineer Office, Detroit, Mich.—Sealed proposals for furnishing about 1,226,000 feet B.M. of Fir Timber will be received here until 11 a.m., Eastern Time, April 30, 1917, and then opened. Information on application to this office, or to U. S. Engineer Offices, Seattle, Wash., and Portland, Ore.

New Rate for Proposals

The April 5 issue of "Engineering News-Record" will have the combined circulation of the "Engineering News" and "Engineering Record."

The price for Proposal advertising in each of the constituent papers has remained for 30 years at $2.40 an inch.

The rate for Proposals in the combined-paper will be

$3.60 an inch

Your Proposal advertisements in "Engineering News-Record" will be seen by practically every worth-while contractor in the entire country.

Engineering News-Record
10th Ave. at 36th Street
New York

Bids received until Apr. 2, 1917.

State Fair Buildings

Syracuse, N. Y.

Sealed proposals for Horse Exhibit Building, Construction, Structural Steel, Horse Stalls, Plumbing and Electric Work at the New York State Fair at Syracuse, N. Y., will be received by the State Fair Commission, 428 South Salina Street, Syracuse, N. Y., until 10 o'clock A.M. on Monday, April 2nd, 1917, when they will be publicly opened and read. Proposals shall be enclosed in an envelope furnished by the State Architect, sealed and addressed, and shall be accompanied by a certified check in the sum of five per cent. (5%) of the amount of proposal. Contractors to whom awards are made will be required to furnish surety company bond in the sum of fifty per cent. (50%) of the amount of contract within thirty (30) days after official notice of award of contract, and in accordance with the terms of specifications Nos. 2708, 2715, 2716, 2717 and 2718. The right is reserved to reject any or all bids. Drawings and specifications may be consulted at the office of the State Fair Commission, 428 South Salina Street, Syracuse, N. Y., at the New York Office of the Department of Architecture, Room 1224 Woolworth Building, and at the Department of Architecture, Capitol, Albany, N. Y. Drawings and specifications and blank forms of proposal may be obtained at the Department of Architecture, Capitol, Albany, N. Y., upon reasonable notice to and in the discretion of the State Architect, Lewis F. Pilcher, State Capitol, Albany, N. Y.

Dated March 12, 1917.

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Bids received until Mar. 31, 1917.

Road Improvements

Welch, W. Va.

Sealed proposals will be received by the County Court of McDowell County, West Virginia, for grading, widening and permanently surfacing with cement, brick or other materials, the main Public Roads in the Adkins, Browns Creek, Elkhorn and Northfork Districts of said County, aggregating sixty-five miles, until March 31st, 1917, at 11 o'clock A.M., at which time the bids will be opened in the office of the Clerk of the County Court, in the Court House at Welch, West Virginia.

Bids must be made on blank forms accompanying specifications, which will be furnished upon application to W. J. McClaren, County Road Engineer, Welch, West Virginia.

Each Bid must be accompanied by a certified check for Five Hundred ($500) Dollars, payable to The County Court of McDowell County.

The County Court reserves the right to reject any and all bids.

By order of the County Court.

W. W. WHYTE, Clerk.

Welch, West Virginia, March 1st, 1917.

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U. S. ENGINEER OFFICE, Portland, Me.—Sealed proposals for furnishing American Portland cement, concrete sand, sand fill and reinforcing steel will be received at this office until 2 P.M., April 23, 1917, and then publicly opened. Information on application.

SPECIAL OPPORTUNITIES SECTION

Contracts To Be Let

Bids received until Apr. 6, 9, 11, 13, 1917.

Repairing State Highways

OFFICE OF THE STATE COMMISSION OF HIGHWAYS

Albany, N. Y.

Sealed proposals will be received by the undersigned at their office, No. 55 Lancaster Street, Albany, N. Y., at 1 o'clock p.m. on Friday, the 6th day of April, 1917, for the repair of highways in the following Counties:

Albany..(one contract—Reconstruction)
Broome..(one contract—Sur. Treatment)
Cayuga.....(one contract—Resurfacing)
Chenango
(one contract—Surface Treatment)
Clinton .....(one contract—Resurfacing)
Cortland ...(one contract—Resurfacing)
Dutchess.(one contract—Reconstruction)
Erie.(one contract—Surface Treatment)
Jefferson
(one contract—Surface Treatment)
Monroe..(two contracts—Reconstruction and Resurfacing)
Oneida.....(two contracts—Resurfacing and Sur. Treatment)
Onondaga..(two contracts—Resurfacing)
Oswego ....(one contract—Resurfacing)
Rensselaer .(one contract—Resurfacing)
Saratoga ...(one contract—Resurfacing)
Schenectady (one contract—Resurfacing)
Tompkins ..(one contract—Resurfacing)

Sealed proposals will also be received by the undersigned on Monday, the 9th day of April, 1917, for the repair of highways in the following Counties:

Albany..(one contract—Reconstruction)
Chemung and Yates
(one contract—Sur. Treatment)
Chenango ..(one contract—Resurfacing)
Dutchess ...(one contract—Resurfacing)
Essex .....(one contract—Resurfacing)
Fulton .....(one contract—Resurfacing)
Genesee, Livingston, Monroe and Wyoming
(one contract—Surface Treatment)
Lewis.(one contract—Surface Treatment)
Livingston .(one contract—Resurfacing)
Montgomery.(one contract—Resurfacing)
Oneida
(one contract—Surface Treatment)
Otsego
(one contract—Surface Treatment)
Onondaga ..(one contract—Resurfacing)
Orleans ....(one contract—Resurfacing)
Rensselaer .(one contract—Resurfacing)
Shoharie
(one contract—Surface Treatment)
Schuyler ...(one contract—Resurfacing)
Schuyler, Tioga and Tompkins
(one contract—Surface Treatment)
Ulster ...(one contract—Reconstruction)
Washington
(one contract—Surface Treatment)

Sealed proposals will also be received by the undersigned on Wednesday, the 11th day of April, 1917, for the repair of highways in the following Counties:

Albany ..(one contract—Reconstruction)
Allegany and Steuben
(one contract—Surface Treatment)
Cattaraugus and Chautauqua
(one contract—Surface Treatment)
Chenango ..(one contract—Resurfacing)
Delaware ..(one contract—Resurfacing)
Greene...(one contract—Reconstruction)
Monroe, Livingston and Ontario
(one contract—Surface Treatment)
Madison
(one contract—Surface Treatment)
Monroe ..(one contract—Reconstruction)
Montgomery
(one contract—Surface Treatment)
Nassau ....(one contract—Resurfacing)
Onondaga.(two contracts—Resurfacing)
Ontario ....(one contract—Resurfacing)
Orleans ....(one contract—Resurfacing)
Otsego
(one contract—Surface Treatment)
Rensselaer
(one contract—Reconstruction)
Steuben ....(one contract—Resurfacing)
Suffolk
(one contract—Surface Treatment)
Ulster .....(one contract—Resurfacing)

Sealed proposals will also be received by the undersigned on Friday, the 13th day of April, 1917, for the repair of highways in the following Counties:

Cayuga, Cortland, Oswego and Seneca
(one contract—Surface Treatment)
Franklin and St. Lawrence
(one contract—Surface Treatment)
Greene
(one contract—Surface Treatment)
Herkimer
(one contract—Surface Treatment)
Livingston .(one contract—Resurfacing)
Monroe and Orleans
(one contract—Surface Treatment)
Monroe and Ontario
(one contract—Surface Treatment)
Montgomery.(one contract—Resurfacing)
Otsego .....(one contract—Resurfacing)
Otsego and Delaware
(one contract—Surface Treatment)
Rensselaer .(one contract—Resurfacing)
Seneca .....(one contract—Resurfacing)
Steuben ...(two contracts—Resurfacing)
Sullivan ...(one contract—Resurfacing)
Tioga and Chemung
(one contract—Resurfacing)
Washington ..(two contracts—Resurfacing and Sur. Treatment)
Wayne .....(one contract—Resurfacing)
Yates .....(one contract—Resurfacing)

Maps, plans, specifications and estimates may be seen and proposal forms obtained at the office of the Commission in Albany, N. Y., and also at the office of the Division Engineers in whose divisions the roads are to be improved. The addresses of the division engineers and the counties in which they are in charge will be furnished on request.

The especial attention of bidders is called to "General Information for Bidders" in the itemized proposal, specifications and contract agreement.

EDWIN DUFFEY, Commissioner.
I. J. MORRIS, Secretary.

Bids received until Apr. 12, 1917.

Highway Surfacing

Greenville, Miss.

The Highway Commissioners of Washington County, Mississippi, will receive at their office in Greenville, Miss., on Thursday, April 12th, 1917, sealed proposals for the surfacing with concrete of approximately 830,000 square yards of highways according to plans and specifications on file. For information apply to J. S. ALLEN, Chief Engineer, Greenville, Mississippi.

Bids received until Apr. 6, 1917.

Bridge Gates

Green Bay, Wis.

Sealed proposals will be received by the Commission Council in and for the City of Green Bay, Wisconsin, at the office of the City Clerk, until April 6, 1917, at 10 o'clock A.M., for the furnishing and installing complete of some type or types of gate or barrier, to be operated electrically, at each end of the following bridges: (1) Walnut St. Bridge over Fox River; (2) Main St. Bridge over Fox River; (3) and for the removal of the existing pneumatic railroad gates now on the Walnut Street Bridge over Fox River, and installing the same complete at the Monroe Avenue Bridge over East River; (4) and the furnishing and installing of two single-post railroad gates with crank operation, one to be located at each end of the Webster Avenue Bridge over East River.

Plans and bids are to be submitted in accordance with general plans and specifications on file with the City Clerk, and to be had on application to the City Engineer, Green Bay, Wisconsin.

Dated Green Bay, Wisconsin, March 12 1917. W. L. KERR, City Clerk.

Bids received until Apr. 10, 1917.

Pipe Sewers

Upper Darby, Pa.

Sealed proposals will be received by the Commissioners of Upper Darby until 8 P.M., Tuesday, April 10th, 1917, for the construction of terra cotta pipe sewers—1. Darby Creek Outfall Sewer; 2. Oakview Sewer District; 3. Southeastern Sewer District.

Plans and specifications on file at the office of the Township Engineer, A. F. Damon, Jr., Post Office Building, Darby, Del. Co., Pa.

Address all bids to William Pendlebury, Secretary of the Commissioners, Cardington, Del. Co., Pa., marked on the outside "Upper Darby Township Sewer Proposal."

A certified check for One Thousand Dollars ($1000.00) must accompany each bid for each section.

The Township reserves the right to reject any or all bids or to accept any portion of any bid.

JOHN TAYLOR WOLFENDEN,
Chairman Sewer Committee.

OFFICE, COMMISSIONERS, District of Columbia, Washington, March 22, 1917.—Sealed proposals will be received at the office of the Secretary of the Board of Commissioners, Room 509, District Building, until 2 o'clock P.M., April 5, 1917, for grading and paving alleys in the District of Columbia with asphalt block, vitrified block and cement concrete. Forms of proposals, specifications and necessary information may be obtained from the Chief Clerk, Engineer Department, Room 427, District Building. OLIVER P. NEWMAN, LOUIS BROWNLOW, CHAS. W. KUTZ, Commissioners, D. C.

SPECIAL OPPORTUNITIES SECTION

Contracts To Be Let

Bids received until Apr. 10, 1917.

Sanitary Sewers

Johnstown, Pa.

LEGAL NOTICE

SEALED PROPOSALS will be received at the office of the Supertinendent of Streets and Public Improvements, City Hall, Johnstown, Pa., until 12 o'clock noon of April 10, 1917, for the construction of sanitary sewers wtih their appurtenances in Section No. 2:

2 Siphon Chambers.
4—42" Sq. Gates and Stands.
76± lin.ft. 39" R. C. P. (in Siphon).
5100± lin.ft. 63" R. C. P. (Main Sewer).
2500± lin.ft. 8" T. C. P. (Rider Sewer).
4 Plain Manholes.
8 Special Manholes.

Plans, specifications and blank proposals can be obtained at the office of the Sanitary Engineer in the City Hall, Johnstown, Pa., upon payment of a deposit of $5.00. This deposit will not be returned unless a bid is submitted. C. P. Collins, San. Engr.

All proposals must be made on the printed forms, as none other will be accepted.

The City reserves the right to reject any or all bids.

By order of the SUPT. OF STREETS AND PUBLIC IMPROVEMENTS.

Bids received until Apr. 5, 1917.

Laying Water Mains

Tarrytown, N. Y.

Sealed proposals will be received by the Board of Water Commissioners of the Village of Tarrytown, N. Y., until 7:30 P.M., Thursday, April 5th, 1917, for laying approximately fifty-three hundred (5300') lin. feet of ten (10") inch cast-iron water mains and approximately seven hundred and thirty (730') lin. feet of eight (8") inch cast-iron water mains, together with valves, hydrants, fittings, manholes, etc.

All bids must be made on regular forms furnished by the Board and must be accompanied by a certified check equal in amount to five (5%) per cent. of the bid.

Plans, specifications, form of contract, etc., may be seen at the office of the Board of Water Commissioners, or copies may be had on deposit of Five Dollars ($5.00), which sum will be returned when plans, etc., are returned.

The Board reserves the right to reject any and all bids.

By order of Board of Water Commissioners JAMES R. LOSEE,
Engineer and Superintendent.

Bids received until Apr 16, 1917.

Street Paving

Bradford, Pa.

Bids will be received until 5 P.M., April 16th, 1917, by E. C. Charlton, City Clerk, for paving on seven streets—approximately 28,000 yds. Certified checks, $500 for each street.

Bids received until Apr. 2, 1917.

Arkansas River Bridge

Sand Springs, Okla.

Sealed proposals will be received by the Board of County Commissioners of Tulsa County, Oklahoma, on Monday, April 2nd, 1917, until 10 o'clock A.M., in the County Court House of Tulsa, Oklahoma, for the wrecking, removal, construction of substructures reërection and furnishing of extra spans for the proposed bridge across the Arkansas River at Sand Springs, Oklahoma. Said bridge to be removed from its present location to a point on the Arkansas River in the immediate vicinity of the intersection of Main Street, Sand Springs, Oklahoma, and the Arkansas River.

According to plans, profiles and specifications now on file in the office of the County Engineer and County Clerk of Tulsa County, Oklahoma.

By order of the Board of County Commissioners of Tulsa County, Oklahoma.
LEWIS CLINE, County Clerk.

Bids received until Apr. 16, 1917.

Tenders for 48-inch and 60-inch Cast Iron Pipes, Specials and Valves

GREATER WINNIPEG WATER DISTRICT

Sealed tenders addressed to the undersigned will be received up to noon on Monday, April 16th, 1917, for the supply of approximately 12,000 ft. of 48-inch and 1300 feet of 60-inch Cast-Iron Pipes, together with numerous specials and Gate Valves.

Specifications and Form of Tender and of Contract may be had upon application to the officers of the District.

The lowest or any tender not necessarily accepted. R. D. WAUGH,
Chairman of Commissioners.
501 Tribune Building, Winnipeg, Man., Can., 13th March, 1917.

Get Your Copy in Early

Owing to the consolidation of "Engineering News" and "Engineering Record" and the longer time required to print, bind and mail the increased edition, all copy for Proposals, Wants and other classified advertisements should be in hand by

Tuesday Noon

The "Big Issue" will be out on Thursday morning.

Engineering News-Record
10th Ave. at 36th Street
New York

Bids received until Apr. 19, 1917.

Creek Improvement and Sewer Extension

Syracuse, N. Y.

Sealed proposals for Contract No. 25 for the construction of Divisions 3, 4 and 5, Onondaga Creek improvement and the main intercepting sewer, will be received until 2:00 o'clock p.m., April 19, 1917, at the offices of the Syracuse Intercepting Sewer Board, 104 City Hall, Syracuse, N. Y. The work embraces approximately 2.0 miles of creek improvement and 1.3 miles of intercepting sewer ranging in diameter from 20 to 27 inches. Proposals may be made under three alternatives which cover the whole or portions of the work. The principal items of the whole work are 111,500 cu.yds. Excavation, 18,000 cu.yds. concrete, 6500 lin.ft. sewers 20 to 27 inches diameter and 5000 lin.ft. sewers 8 to 24 inches diameter. Proposals must be made on blanks to be furnished upon application and must be accompanied by a New York draft or certified check for $5000.00 or $10,000.00 for each division for which a bid is submitted. Drawings, specifications and form of proposal and contract are on file in the offices of the Board. Copies may be obtained by depositing $10.00 to insure their return in acceptable condition on or before May 1, 1917.

HARRY J. HAMLIN, Secretary.

Bids received until Apr. 19, 1917.

Flood Prevention Project

CONTRACT NO. 1

City of Lebanon, Pa.

Sealed proposals directed to the City Clerk will be received by the Mayor and Council of the City of Lebanon, Pa., at the City Hall, until 5 P.M., Thursday, April 19th, for the furnishing of all labor and materials required to construct Contract No. 1 of Lebanon's Flood Prevention Project.

The work consists of channel straightening and lining with reinforced concrete, reinforced-concrete culverts, and bridges.

The approximate quantities involved are:

26,000 cubic yards of Excavation
4,500 cubic yards of Concrete
200,000 pounds of Reinforcement
90,000 pounds of Structural Steel

Plans, proposal blanks and information concerning the manner of submitting bids can be obtained at the office of the City Engineer of Lebanon, Pa., after the 4th day of April, upon making a deposit of $5.00. This deposit will be refunded upon return to the City Engineer of the plans and specifications in good condition.

A certified check for $6000 must accompany each proposal.

Mayor and Council distinctly reserve the right to reject any or all bids and to award the contract as is deemed to the best interests of the City of Lebanon, Pa. PAUL A. VOLCKER,
City Engineer.
DAN. M. SHARP, City Clerk.

SPECIAL OPPORTUNITIES SECTION

Contracts To Be Let

Bids received until Apr. 10, 1917.

Grit Chamber

BUREAU OF SURVEYS
DEPARTMENT OF PUBLIC WORKS
Philadelphia, March 16, 1917.

Sealed proposals will be received at Room 216, City Hall, until 12 o'clock noon on Tuesday, April 10, 1917, and opened at that time in Room 412, City Hall, for Grit Chamber north of Lycoming Street and west of "O" Street, including:

Contract 16—Construction of a Reinforced-Concrete Grit Chamber with Inlet and Outlet Sewers and a Superstructure.
Contract 16A—Machinery and Equipment.
Contract 16B—Electric Wiring and Fixtures.
Contract 16C—Plumbing.
Contract 16D—Heating and Incinerator.
Contract 16E—Ventilating.

Inquire at Room 534, City Hall.

GEORGE E. DATESMAN, Director.

Bids received until Apr. 16, 1917.

Tenders for Bronze Castings and for Brass Pipe and Fittings for Venturi Meter

GREATER WINNIPEG WATER DISTRICT

Sealed tenders addressed to the undersigned will be received up to noon of Monday, April 16th, 1917, for the supply of miscellaneous Bronze Castings, Brass Piping, etc., which enter into the construction of a Venturi Meter.

Specifications and form of tender may be obtained at the offices of the District.

The lowest or any tender not necessarily accepted. R. D. WAUGH,
Chairman of Commissioners.

501 Tribune Building, Winnipeg, Man., Can., 13th March, 1917.

Bids received until Apr. 10, 1917.

Public Road Work

Madisonville, Ky.

Sealed proposals for building two (2) miles of waterbound macadam on Madisonville and Dixon State Aid Road, No. 54 A2, Hopkins County, Kentucky, will be received at the office of John G. Salmon, County Court Clerk, of Hopkins County, Kentucky, until 1:00 p.m., Tuesday, April 10, 1917, at which time and place they will be publicly opened and read.

Bids must be made on the blank form contained in the Specifications.

Specification and plans will be furnished by the county engineer upon application and a cash payment of $2.50 to cover cost of same

No bids will be received unless accompanied by a certified check for the sum of Five Hundred ($500) Dollars, payable to the Fiscal Court of Hopkins County, Kentucky.

The successful bidder will be required to give bond, and to comply with the Acts of the General Assembly of the Commonwealth of Kentucky, respecting contracts.

By the order of the Fiscal Court of Hopkins County, Kentucky, this the Tenth day of March, Nineteen Seventeen.

JOHN G. SALMON,
County Court Clerk.
J. M. FLANAGAN, County Engineer.

Bids received until Apr. 9, 1917.

Paving

Plainfield, N. J.

Sealed proposals will be received by the Common Council of the City of Plainfield, N. J., at the Council Chamber in said City, on Monday, April 9, 1917, at 8:30 o'clock P.M., for paving certain streets with reinforced concrete and with vitrified brick.

The approximate amount of the principal items of work to be performed is as follows:

20,000 sq.yds. of vitrified brick pavement.
28,000 sq.yds. of reinforced-concrete pavement.
20,000 lin.ft. of concrete curb.

Plans, specifications and forms of proposal may be obtained at the office of Andrew J. Gavett, Street Commissioner, 151 North Avenue, Plainfield, N. J.

OFFICE OF THE COMMISSIONERS, D. C., March 26, 1917.—Sealed Proposals will be received at this office, Room 509, District Building, until 2 o'clock P.M. on April 9, 1917, for the construction of sewers in the District of Columbia, involving the construction of approximately 12,000 linear feet of pipe and masonry sewers, 10" to 9' 3" diameter. Forms of proposals, specifications and necessary information may be obtained from the Chief Clerk, Engineer Department, Room 427, District Building, Washington, D. C. OLIVER P. NEWMAN, LOUIS BROWNLOW, CHARLES W. KUTZ, Commissioners, D. C.

UNITED STATES ENGINEER OFFICE, Room 710 Army Building, 39 Whitehall Street, New York, N. Y.—Sealed proposals for building one two-story eight-room stucco Lock Master's House at the Lock, Hudson River, at Troy, N. Y., will be received at this office until 12.00 o'clock noon, April 13, 1917, and then publicly opened. Information on application.

UNITED STATES ENGINEER OFFICE, Room 710 Army Building, 39 Whitehall Street, New York, N. Y.—Sealed proposals for furnishing and delivering 8500 tons (more or less) of bituminous coal at Albany, N. Y., will be received at this office until 12:00 o'clock noon, April 9, 1917, and then opened. Information or application.

TREASURY DEPARTMENT, Supervising Architect's Office, Washington, D. C., March 17, 1917.—Sealed Proposals will be received at this office until 3 p.m., April 16, 1917, and then opened, for new roof and miscellaneous repairs, for laundry building, Bureau of Engraving and Printing, Washington, D. C., in accordance with the specification and drawings Nos. 100-B, 400-B and 401-B, copies of which may be had at this office, in the discretion of the Supervising Architect. JAS. A. WETMORE, Acting Supervising Architect.

PROPOSAL FOR STANDARD REVETMENT—U. S. Engineer Office, Kansas City, Mo.—Sealed proposals will be received here until 12 noon, April 9, 1917, and then opened, for constructing about 17,000 feet standard revetment on Missouri River, about 45 miles below Kansas City, Mo. Information on application.

U. S. ENGINEER OFFICE, Old Federal Building, Wilmington, Del.—Sealed proposals for dredging Leipsic and Little Rivers, Del., will be received here until 11 A.M., April 2, 1917, and then opened. Further information on application.

PROPOSALS FOR DREDGING—U. S. Engineer Office, Boston, Mass.—Sealed proposals for dredging in Weymouth Fore River, Mass., will be received here until 12 M., Apr. 18, 1917, and then opened. Further information on application.

PROPOSALS FOR ELECTRIC CABLES AND WIRE—U. S. Engineer Office, Detroit, Mich.—Sealed proposals will be received here until 11 a.m., Eastern Time, May 1, 1917, and then opened, for furnishing and delivering at Sault Ste. Marie, Michigan, Electric Cables and Wire. Further information on application.

EXECUTIVE OFFICE; COMMISSION ON MEMORIAL TO WOMEN OF THE CIVIL WAR; 1729 New York Avenue, Washington, D. C., March 29, 1917.—Sealed proposals for the construction of the approaches to the Memorial to Women of the Civil War, Washington, D. C., will be received here until 12 o'clock noon, Monday, April 16, 1917, and then publicly opened. Information upon application. WM. W. HARTS, Colonel, U. S. A., Executive Officer.

PROPOSALS FOR DREDGING—U. S. Engineer Office, Savannah, Ga.—Sealed proposals will be received here until 12 o'clock noon (Eastern Standard Time), April 14, 1917, and then opened, for dredging harbor at Savannah, Ga., 21-foot channel. Further information on application.

Engineering News-Record

April 5. 1917 Issue

will have a circulation of

40,000 Copies

—a good issue in which to print that advertisement of your contract-to-be-let.

SPECIAL OPPORTUNITIES SECTION

Employment Department

ANSWERS addressed to us at 10th Ave. and 36th St., New York, or 1144 Monadnock Block, Chicago, will be forwarded without charge (excepting circulars or similar literature).

IMPORTANT: Original letters of recommendation or other papers of value should not be enclosed to unknown correspondents—send copies. Advertisers' names will not be furnished under any circumstances. Copy received until 10 a.m. Tuesday for Thursday's issue.

Positions Open

ENGINEER of four to eight years' works experience wanted to take responsible position in established industry; general all-around ability in plant operations necessary; applicant should have had good training, fundamentals, chemical and electrical engineering; experience in metallurgical and electric furnace work desirable but not necessary; give full history and state salary expected. P192—Eng. News.

COMBUSTION ENGINEER wanted, experienced in power-plant and stoker operation; familiar with modern instruments. Apply Charles B. Buerger, Atlantic Refining Co., 3144 Passyunk Ave., Philadelphia.

DRAFTSMEN wanted; maps and profiles, Federal valuation; state experience and submit samples. Jas. G. Wishart, office engineer. C. R. I. & P. Ry., Chicago, Ill.

DRAFTSMAN for general power-plant and interurban work; technical graduate; state salary and submit samples. P253—Eng. News, Chicago.

DRAFTSMAN AND DESIGNER wanted, experience in steam power plant design and layout; state fully in first letter age, education, experience, references, salary expected and when available; location, western Massachusetts. P290—Eng. News.

TWO YOUNG ENGINEERS wanted immediately to make surveys, give lines, grades and supervise construction of water, sewer and street work; salary, $80 per month; state education and experience with references. P279—Eng. News.

STRUCTURAL STEEL DESIGNERS and estimators wanted for general mill and office building work; state education, experience and salary required. P305—Eng. News.

STRUCTURAL STEEL DETAILERS familiar with mill office building and hip and valley work; must be rapid and accurate; state experience, reference and salary in first letter. P304—Eng. News, Chicago.

CAPABLE TECHNICAL MAN wanted to prepare plans for sewer system; advise of training, experience and salary desired in first letter. P312—Eng. News.

ENGINEER wanted to open and take charge of Philadelphia office established firm New York consulting engineers; invest from two to three thousand dollars; no triflers. P334—Eng. News.

WANTED

Superintendent

For Manufacturing Plant in Canada, employing about one hundred men, must have executive ability, thorough understanding of the operation of machine tools and pattern shop work essential. Must be all-round man. State age, salary and qualifications. Confidential.

P245—Eng. News.

RATES

UNDISPLAYED

"Positions Wanted," 3 cents a word, minimum charge 50 cents an insertion, payable in advance.

"Positions Open" and all other undisplayed Want and For Sale advertisements, 5 cents a word, minimum charge $1.50 an insertion.

Tabulated or paragraphed advertisements 30 cents a line.

(When replies are to be received in our care, allow four words for the box address.)

DISPLAYED

1 inch one time—$3.00. Rates for larger spaces and longer terms furnished on request.

Advertisements for bids (Proposals) $2.40 an inch.

INSPECTOR wanted, experienced in expediting machinery deliveries. Apply in writing, giving particulars, experience, etc., to Matthew F. Roberts, 3144 Passyunk Ave., Philadelphia, Penn.

COMPETENT DRAFTSMAN wanted, familiar with oil refinery work; state experience and salary expected. P333—Eng. News.

DRAFTSMAN wanted who has had experience in the varied requirements of a large industrial plant, both as to building construction and equipment; state age and salary expected and experience particulars. P332—Eng. News.

FOREMAN TOOL SHARPENER wanted to take charge of shop making, sharpening and tempering steel for hard rock tunnels and excavation; shop equipped with oil furnaces and Sullivan and Leyner tool-sharpening machines; applicants must give full experience, names of people for whom they have worked and salary desired. Address Tallassee Power Co., Alcoa, Blount County, Tenn.

DRAFTSMEN for structural steel work; several experienced men wanted. Milliken Brothers (Incorporated), Milliken, Staten Island, New York City. Telephone West New Brighton 1200.

FIRST-CLASS MAP DRAFTSMEN wanted; send sample of line and lettering work and statement of salary expected. Address Civil Engineering Department, Drawer F, Bartlesville, Okla.

STRUCTURAL DETAILER wanted for structural shop in Havana, Cuba; must be fully experienced, rapid and accurate on mill building work; state experience, references and salary at once; good position for right man; transportation to Havana. P328—Eng. News.

EXPERIENCED MECHANICAL DRAFTSMEN; permanent positions on elevating and conveying machinery, light plate and structural work. P326—Eng. News.

MAN wanted thoroughly familiar with general contract estimating in all of its branches; also familiar with office detail work of general contractors; must have considerable previous experience; references. P323—Eng. News.

FIELD SUPERINTENDENTS wanted, thoroughly familiar with general contract work, especially mill building construction of steel and reinforced concrete; must be able to handle men and materials economically; references. P324—Eng. News.

DRAFTSMEN wanted with experience in elevating and conveying machinery and general cement plant work; state education, experience and salary expected. P318—Eng. News.

GOOD LETTERERS

are preferred everywhere—draftsmen proficient in my system, the "Engineering News" style of lettering. Taught by mail only. Results guaranteed.

C. W. Reinhardt
Arlington, New Jersey

Freehand Lettering

DRAFTSMAN, experienced on industrial and power-plant layout and construction work, concrete, steel, mechanical. P354—Eng. News.

STRUCTURAL DETAILERS and checkers, eastern Pennsylvania district; state age, experience, salary expected and when available. P342—Eng. News.

Civil-Service Opportunities

Examinations for these positions will be held on or up to the dates given.

JUNIOR ASSISTANT, Engineering Department (May 5, 1917); $901 to $1200. State Civil Service Commission, Albany, N. Y.

ASSISTANT CIVIL ENGINEER, Corps of Civil Engineers, United States Navy. Write Chief of Bureau of Yards and Docks, Navy Dept., Washington, D. C.

Employment Agencies

The Agencies advertising here agree to refund any registration fee on demand any time within the first six months when no position is secured.

LABOR BUREAUS

EMPIRE LABOR AGENCY, 93 Mulberry St. (Tel. 1745 Franklin), New York Laborers and mechanics, furnished for all kinds of construction works, free of any fee, provided transportation is advanced. Also commissary conducted.

SPECIAL ADVANTAGES to contractors or others employing laborers, carpenters, mechanics, drill runners, foremen, etc.; commissary privileges optional. Central Labor Agency, 139 Mulberry St., New York. (Tel. Canal 8970.)

CORRESPONDENCE SERVICE

THE UNDERSIGNED provides a service that is designed, through correspondence, to locate openings and conduct confidential preliminary negotiations without jeopardizing present connections or detracting in the slightest degree from your own standing, dignity or personality. Established 1910. Covers preliminary negotiations only, by correspondence. Positions between $2500 and $25,000 exclusively. Strictly confidential. Ask for explanation. R. W. Bixby, T1 Niagara Square, Buffalo, N. Y.

Positions Wanted

Mechanical and Electrical Engineers

MECHANICAL ENGINEER, six years mechanical and electrical designing with three years' shop experience; technical education; age 25; wishes permanent position in engineering department. PW 329—Eng. News.

Civil Engineers

GRADUATE CIVIL ENGINEER; eight years' experience, five in factory design and construction. PW158—Eng. News.

STRUCTURAL DRAFTING

A new correspondence course of instruction and work leading up to actual (paid) experience.

STRUCTURAL STEEL DESIGNING

A complete course of instruction and work reproducing all the conditions of actual experience By mail only.

REINFORCED CONCRETE ENGINEERING

In its fourth year of successful operation. This course has established a reputation among engineers that is not equalled by any similar correspondence course on this subject.

M1000—Engineering News

SPECIAL OPPORTUNITIES SECTION

Employment Department

EXPERT in hydraulic dam design and construction desires association with firm of contractors engaging in such work; salary $500 per month; will earn every dollar of it. For information to convince, address PW197—Eng. News.

HIGHWAY ENGINEER, 34, desires position; 10 years field and office, highways, sewers, surveying, development and supervision. PW269—Eng. News.

CIVIL ENGINEER, 28, eight years' experience in building work, reinforced-concrete work, railroad construction, location and valuation, reinforced-concrete bridge work, highway road construction, desires and is available for general construction work at any place at once. PW 249—Eng. News.

CIVIL ENGINEER, over 20 years' experience railroad location, construction and maintenance, last three years valuation, now employed, desires responsible position. PW193—Eng. News.

GRADUATE CIVIL ENGINEER (29), three years' construction, surveying and drafting experience, 10 years' legal, business and secretarial experience, familiar with industrial organization, highest credentials, seeks position offering opportunities for advancement. PW293—Eng. News.

TECHNICAL GRADUATE, five years' experience topography and railway construction, at present engaged in city work, desires position with topography party or preliminary railway survey; location immaterial. PW291—Eng. News.

CIVIL ENGINEER, 3½ years' technical training and 1½ years' experience, including municipal and railroad engineering and river improvement work, desires position as transitman or foreman on new construction. PW327—Eng. News.

DO YOU NEED a competent and reliable man who has specialized for nine years on plain and reinforced-concrete design and construction? PW330—Eng. News.

CIVIL ENGINEER, experienced designer and estimator on structural steel, wants position; languages; willing to go abroad. PW322—Eng. News.

PRACTICAL RIVER AND HARBOR MAN; graduate civil engineer; married, 28; six years in charge of engineering and surveys for dredging and river and harbor construction; engineer for dredging contractor in Mexico, Texas and Florida; go anywhere on responsible position. PW321—Eng. News.

CIVIL ENGINEER, educated; experience location, construction, maintenance and valuation; understands cost accounting and cost data work; now employed; wishes a position in valuation work. PW 319—Eng. News, Chicago.

CIVIL ENGINEER, Assoc. M. Am. Soc. C. E., age 33, single; five years in tropics; speaks Spanish; thorough experience in the investigation, design and construction of hydraulic work, including irrigation, power development and hydrographic engineering; at present designing engineer on one of the largest irrigation projects of the West; characteristics, initiative, energy and thorough technical training; seeking position in South America. PW317—Eng. News.

CIVIL ENGINEER where technical knowledge, ambition, "push" and ability are essential; eight years' experience design, construction reinforced-concrete and steel, also land reclamation and investigating engineer; location, New York City. PW345—Eng. News.

RESIDENT ENGINEER (civil) and superintendent of construction, age 28, open for engagement (with company doing own construction) May 1, or sooner; nine years' experience, railroad construction, electrification, bridges, foundations, tunnels, sewers, pipe lines, road work, heavy plant and mill building, blast furnace, rolling mill, power plant, terminals, dock, municipal work. Have following organization: Chief of party, instrumentman, computer, rodman, carpenter foreman (American), concrete foreman (American), 25 handy men (American), 150 laborers (picked), Serbian. Go anywhere for one year's work. PW349—Eng. News, Chicago.

YOUNG CIVIL ENGINEER, recent graduate, desires position with firm of engineers or contractors located in or near New York City. PW350—Eng. News.

ENGINEER, Assoc. M. Am. Soc. C. E., seven years in charge railroad construction, now in West, desires position, assistant engineer, anywhere. PW338—Eng. News, Chicago.

CIVIL ENGINEER, 13 years' experience, seven years in charge construction railroads, tunnels, bridges, wishes position, assistant or resident engineer. PW 339—Eng. News, Chicago.

CIVIL ENGINEER, technical man, four years' experience, field and office, good draftsman, wishes position. PW343—Eng. News.

DESIGN AND CONSTRUCTION OF WATER-WORKS from investigation of source to completion, including dams, wells, reservoirs, pipe lines, pumping stations and purification plants; seven years' responsible charge; Cornell University C. E.; Assoc. M. Am. Soc. C. E.; lately completed rehabilitation of plant costing upward of $1,000,000; available in May. PW340—Eng. News, Chicago.

Bridge and Structural

BRIDGE AND STRUCTURAL ENGINEER, thoroughly competent, desires responsible engagement. E. J., 72 Trinity Place, Room 502, New York.

ENGINEER, structural; executive position; technical education; 16 years' experience, largely industrial and power plants. PW325—Eng. News.

Surveyors

INSTRUMENTMAN — Capable instrumentman desires position; experienced in all lines; technical and neat draftsman; location, Iowa. PW341—Eng News, Chicago.

Draftsmen

CHIEF DRAFTSMAN of structural steel company; executive ability; good organizer; several years' experience in responsible position. PW271—Eng. News, Chicago.

LADY desires position as draftsman engineer's office; salary moderate; location anywhere. PW336—Eng. News, Chicago.

DRAFTSMAN, 21, technical high school graduate, 2½ years' experience as detailing draftsman, desires position with large concern. PW331—Eng. News.

STRUCTURAL DRAFTSMAN, junior, good tracer and letterer, wishes position. PW344—Eng. News.

DRAFTSMAN, university graduate, civil engineer, 10 years' responsible experience, construction and office, reinforced concrete, highways, topographical, structural, railroad, employed, desires change with better opportunity. PW334—Eng. News.

DRAFTSMAN, college graduate, three years' experience, steel and concrete, desires position with opportunity. PW332—Eng. News.

Structural and Editorial Experience Offered

College graduate with 9 years' experience as engineering teacher, 6 years as structural detailer and designer and 2 years as associate editor in charge of the structural field, desires position after April 1, preferably with large organization as designer and technical writer for engineering publicity.

PW294—Eng. News.

CONTRACTING OPPORTUNITY

The owner of a considerable line of Contracting Machinery (Trenchers and Dry Land's) would like to join with men of experience, with the object of getting the machinery to work on a mutually paying basis.

Worth investigating by sewer and drainage foremen, superintendents and small contractors.

Replies must state fully past experience and present requirements, and will be treated as confidential.

M247—Eng. News, Chicago.

Read This *BEFORE* You Write

In a new book of 176 pages on "Selling Your Services," there is a large amount of good advice—some of it worth many times the price of the book—including the following:

"The average letter of application starts with a few inane remarks, continues with a few sentences covering the applicant's education and experience, and ends up by crediting the author with a few general qualities, like honesty, ambition and enthusiasm. If you write the kind of letter in answer to an advertisement, you may be sure that most of the letters received by the prospective employer will be just like it. Therefore, if you want to head your letter toward the waste-basket, write it in this form.

"A better way is to analyze carefully the requirements stated by the employer and decide just how your own experience fits in with these requirements. Then lay your plans to demonstrate to the prospective employer that your previous training and experience have fitted you to be of service to him in the manner outlined in his advertisement.

"* * * When writing your letter of application bear firmly in mind that your prospective employer has no other means of appraising your services than by your letter. He is not a mind reader and can judge only from the actual contents of your letter.

"* * * You may be exceptionally capable in your field, but you will find yourself greatly handicapped in trying to better yourself if you do not write a good letter of application.

"* * * Therefore, unless you know that your letter will create a favorable first impression do not waste postage on it."

A man complained that he had replied to more than 30 advertisements of positions that he was competent to fill but had not received an acknowledgment of a single letter The general appearance of his letter to us was the answer.

Your letter of application may be your one opportunity to secure just the position for which you are peculiarly fitted and have been looking all your life. You should make the most of it by giving it the same care you would a proposal to an heiress.

Engineering News

SPECIAL OPPORTUNITIES SECTION

Miscellaneous

DRAFTSMAN, Columbia civil engineering graduate, three years' general and structural experience, also field, desires change with opportunity. PW348—Eng. News.

Superintendents

SUPERINTENDENT of construction; first-class executive, broad experience; difficult foundations, locks, dams, bridges, building and industrial plant construction; concrete a specialty. PW1,001—Eng. News.

CONTRACTORS' CONSTRUCTION SUPERINTENDENT; 17 years' general experience all quarries, dams, embankments, roads, culverts, retaining walls, piers, arches, pipe lines, using all uptodate machinery equipment. PW259—Eng. News.

CONSTRUCTION SUPERINTENDENT and general foreman, heavy construction, excavation, concrete, tunnels, docks, buildings and pipe work. PW265—Eng. News.

SUPERINTENDENT OF CONSTRUCTION for general contractor; graduate civil engineer; 10 years' field and office experience in building construction; age 33; good executive; available soon; salary $200. PW277—Eng. News.

SUPERINTENDENT, 40, 15 years' practical experience in charge of all kinds of heavy construction; have large following of all kinds of construction workmen; first-class organizer, resourceful and aggressive; will go anywhere; can report at once. PW347—Eng. News.

Miscellaneous

CHIEF ENGINEER wants position in charge of power plant for manufacturer or central station; high-grade man of exceptional ability; thoroughly understands all classes of equipment; broad experience; excellent references. PW306—Eng. News.

YOUNG MAN, 24, experienced in railroad, highway and general construction, desires position as material man, timekeeper, instrumentman or map draftsman. PW240—Eng. News.

EXPERIENCED FOREMAN on construction work wishes position; can furnish large number of laborers if necessary. PW310—Eng. News.

PROFESSOR of electrical engineering in university of good standing, 15 years' educational, engineering and commercial experience, will consider openings offering greater opportunities; forceful writer; author two successful books; location immaterial. PW149—Eng. News.

WOMAN SECRETARY and stenographer, five years' experience with prominent engineer, three years with import house, familiar with engineering terms and practice, desires position with consulting engineer in New York City; best references. PW320—Eng. News.

GENERAL CONCRETE FOREMAN, 10 years' experience in all branches of concrete building construction, open for position; wide experience on concrete roads and pavements. PW337—Eng. News.

GENERAL FOREMAN, carpenter, and concrete foreman, on concrete water purification and sewage-disposal plants, concrete arch bridges, cofferdams and caissons, heavy timber structures, tunnel lining and railroad work; 20 years' practical experience; age 40; highest references from past employers; available immediately; go anywhere. PW346—Eng. News.

Wanted

Whitehead Compressor

wanted. Give particulars and price. Box 208, Chicago Heights, Ill.

Here

—is the place for your announcements when you want to buy or sell second hand equipment.

Agents & Salesmen

Sales Engineer

will accept fuel, power, construction and mechanical equipment for eastern Pennsylvania, New Jersey, Delaware, Maryland; commission or special. W353—Eng. News.

Miscellaneous

TRAINED MEN in municipal surveying from assistant engineers to chainman desire positions with private firms, railroads or municipalities. M335—Eng. News.

PATENT ATTORNEYS

IMPROVEMENTS wanted. Send for free bulletins listing manufacturers' wants and book "Inventions—Patenting and Promoting." Lancaster & Allwine, 272 Ouray Bldg., Washington, D. C.

Educational

TECHNICAL MEN are wanted for Federal Civil Service. We coach by correspondence for many of these examinations. Write for free booklet QF 806. Washington Civil Service School, Washington, D. C.

For Sale

Bound Volumes

Nos. 50 to 62 inclusive of the "Engineering News" for sale; excellent condition; best offer accepted. Call or write W. Vandenburgh, 50 East 42nd St., New York City.

Rails

For Sale—125 tons of 70-lb. 7-in. T-rails, second-hand, with splice bars; also plate girders 27 to 34 ft. long, 3 ft. 6 in. high. Inquire I. Kamrass, Long Branch, N. J.

FOR SALE—One new Steel

FACTORY BUILDING

56 ft. wide, 60 ft. long and 60 ft. high.

For further particulars communicate with

Bear Creek Mfg. Co. - Petrolia, Pa.

MAPS AND CHARTS

Lithographing — Engraving — Photolithographing and Printing of

MAPS, DIAGRAMS AND PLANS

JULIUS BIEN, 156 Fifth Ave., New York

this advertisement

might be your own and get you the attention of other readers of Engineering News. They number over 20,000.

Have you anything to sell them?

WANTED

Several 5, 6 and 8-ton

Tandem Steam Rollers

and some 10-ton 3 wheelers (steam). Must be in complete, good operating condition, and cheap for spot cash. Give make, age, etc., and reply at once.

WILLIS SHAW

239 Railway Exchange, Chicago, Ill.

STEEL SHEET PILING WANTED

We are in the market for 7000 sq.ft. of steel sheet piling in 20 ft. lengths. Must be in first-class condition.

A. A. PARKER

Waterford - - - New York

WANTED

Two 10 H.P.

BOILERS

mounted on wheels. State age, condition and price.

The B. D. PIERCE Jr., CO.

122 Bank Street - Bridgeport, Conn.

WANTED

Steubner, self-righting, tip-over

BUCKETS

½ to 2 yards capacity

W 752—ENGINEERING NEWS

FOR RENT

Portable Boilers	Engines
Centrifugal Pumps	Hoisters
Air Compressors	Derricks
Concrete Mixers	Pile Drivers

MARVIN BRIGGS, INC.

167 Sixth Street - Brooklyn, N. Y.

FOR SALE—11 Sullivan DP-33

Rotator Hammer Drills

for immediate delivery

Henry & Gray, 558 Broome St., N. Y. City

'Phone—Spring 8954

Newman Clock Company

Solicits watchclock repairs. Work correctly and promptly done. Dials at lowest prices.

178 Fulton St., New York

565 W. Washington Blvd., Chicago

SPECIAL OPPORTUNITIES SECTION

Second Hand Equipment

FOR SALE—Immediate Delivery

DREDGE

Equipped to dredge, screen, wash and load sand and gravel. Also big deposit gravel. Address:

917 Hudson Bldg., New York

FOR SALE

Hoists—Lidgerwood, Rawson - Morrison and National

Boilers—Upright and Horizontal, Portable and Stationary

Mixers—Haines-Weaver, ½ cu.yd. No. 4 Smith with engine

Buckets—Clamshell, ¾-yd. Orange peel ½ and 1 cu.yd.

Compressor—Chicago - Pneumatic, gasoline driven, with cooling tower, 150 cu.ft. capacity

Pumps—Steam, Pulsometer
—Cameron, with engine
—Centrifugal, with engine

Plank Driver—Ingersoll-Rand No. 5.

Trucks, Wagons, Wheelbarrows, etc.

Kingsbridge Contracting Co.
Maspeth Ave., Maspeth, L. I., N. Y.

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BARGAIN IN BOILERS
$400 each

3—125 H.P., 110 lb. pressure, McEwan return tubular with fittings; now in use. Installing larger units. Hartford Insurance.

ALTA ENGINEERING CORPORATION
50 Hudson Terminal New York, N. Y.

TEN-TON STONE WAGONS

We have seventeen ten-ton Buffalo Pitts Reversible Hauling Wagons—Self Spreaders—Good condition, for sale cheap.

UNION PAVING COMPANY
30th and Locust Streets. Philadelphia, Pa.

WANTED

FIRE PUMP

One National Standard Fire Underwriters' Pump, 1500 g.p.m., cylinders 20 in. x 12 in. x 16 in. Must be in first-class condition. Steam pressure 135 lbs., Water 125 lbs.

P. O. Box 904 - - Reading, Pa.

WANTED

Contractors' plants and equipment bought for cash.

Pipe & Contractors Supply Co.
3 Dover Street - New York City

WANTED

Thew Steam Shovel, Type "O" to rent with privilege of buying.

Majestic or Cascade **Gasoline Pump.**

McKiernan-Terry **Pile Hammer.**

A Frame **Trench Crane**

Lackawanna **Steel Sheet Piling** ⅜ x 12 in., about 12 ft. lengths

A John Byers **Traction Crane.**

Give particulars, including price in first letter.

Leffingwell & Regan
38 Spring St., Montclair, N. J.

This Opportunity Will Never Come Again

The first issue of Engineering News-Record, April 5, will have a circulation of 40,000. It will bulge with special features and special advertisements. It will be seen and read by about every worth-while contractor in this country.

The spring construction season is opening with a rush. Already there is a loud noise for plant and equipment that manufacturers cannot supply promptly.

Take a full page, or a double-page spread, and publish in this big important number, with its double circulation, a complete list of the items that you can furnish promptly.

Wire your reservation and send copy quickly. Last form goes to press Tuesday noon, April 3.

Engineering News-Record

10th Avenue and 36th Street - - - New York

SPECIAL OPPORTUNITIES SECTION

Second Hand Equipment

LOCOMOTIVE CRANES

10-ton, 4-wheel Browning
15-ton, 4-wheel, 10-ft. gauge Browning
5-ton, 4-wheel Williamson
5-ton, 4-wheel Brown Hoist Traction
15-ton, 8-wheel Industrial

Peerless Crane, 14-ft. 6-in. gauge, with 35-ft. boom
1-yd. Owen Clamshell Bucket
7 x 10 Stroudsburg Engine

DERRICKS

1 Stiff-Leg, 35-ft. mast, 60-ft. boom
3—Guy, 65-ft. mast, (14 x 14), 60-ft. boom (12 x 12)

BUCKETS

6—1⅝-yd. Steubner Bottom Dump
1—1-yd. McMyler Clamshell
1—1-yd. Owen Clamshell
1—1½-yd. Class "E" Hayward Clamshell
1—1-yd. Williams Clamshell
1—70 cu.ft. Brown Hoist Clamshell

J. C. HOUSTON
50 Church St., New York, N. Y.

FOR SALE

PORTABLE TRACK

15,000 ft., 24 in. gauge, 20 lb. rail

"V" SHAPED CARS

28—1½ yd. capacity, 24 in. gauge

LOCOMOTIVE

1—6 ton Baldwin, 24 in. gauge, overhauled

STEAM SHOVEL

1—Model 45 Bucyrus, 1¼ yd. dipper

LOCOMOTIVE CRANE

1—Gasoline operated Crane on caterpillar wheels. Operates one yard clam shell

GYRATORY CRUSHERS

All sizes, No. 9 to No. 2

HERBERT GIVIN CO.
30 CHURCH ST. - NEW YORK

CONCRETE PLANT FOR SALE

1-yd. Smith Chicago Mixer with power loader, boiler and engine.
6-in. Centrifugal Pump with 10 H.P. Novo engine and hose.
Insley chuting system.
Used six months. Sell for fifty cents on dollar.
Located at Chatham, Va.
H. P. Cochran - - Gate City, Va.

Contractors, Quarrymen, Etc.

We are particularly strong right now on high-grade "used" large and small

Steam Shovels
Locomotives
Cars
Hoisting Engines
Road Rollers
Stone Crushers
Stone Skips
Steel Sheet Piling
Etc.

Send us your inquiries—we can save you money. Remember "what we say it is, it is."

Wm. B. Grimshaw Co.
688 Drexel Bldg. - Philadelphia, Pa.

FOR SALE

Idle Machinery and Equipment

Immediate Delivery

AETNA CHEMICAL COMPANY, INC.
120 Broadway - New York, N. Y.

HOISTS

Compressors - Boilers - Mixers
Derricks - Cableways

For Sale or Lease

HOISTING ENGINE SALES CO.
Grand Central Station, New York

SHOVEL

70-ton Bucyrus Steam Shovel, complete with 2½ yd. bucket; excellent condition; available at once.

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8 tons 1¼ in. round "Jakos" Swedish Bars for immediate shipment from our N. Y. Warehouse.

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1—No. 0 Thew Steam Shovel
1—Keystone Excavator
2—10-ton Steam Rollers
1—Complete Portable Crushing Plant
1—Feed Water Heater with copper coil and 4-6-4 Duplex Pump.

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FOR SALE—About 450 ft. 48 in.

New Cast Iron Bell and Spigot Pipe

Class "B." Prompt shipment, subject to prior sale.

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Standard Gauge Contractors Equipment
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Six Driver Baldwin Locomotive, 42 tons, 140 lb. steam, new firebox recently.
Western Spreader Car, practically new.
20—12 yd. Oliver Hand Dump Cars—good condition. Address:
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ALL MAKES

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FOR SALE
Thew "O"

STEAM SHOVEL

Thew "A-1" Steam Shovel.

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DOUBLE DRUM HOISTER

with engine mounted on wheels. Good condition. Price $500 f.o.b. Bridgeport.

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Engineers' Used Instruments Have a Definite Market Value

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REINFORCING SPACER

We have a small stock of slightly rusted spacer for 2 in., 3 in., 4 in., 5 in. and 6 in. spacing of small reinforcing bars.

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Road Roller Bargain

Macadam Roller in excellent shape.

FS98—Eng. News.

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Best cash prices paid.

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Dealers in new and used engineering instruments.
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RAILS 50 Miles 60 Lb.

A.S.C.E. Section with continuous bars.
Almost New. Western Delivery.

CARS, EQUIPMENT, PILING
"ZELNICKER" in ST. LOUIS

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10,000 tons of first-class Relaying Rails, suitable for export.

Also, a large tonnage of 30 to 75 lb. Relaying Rails, with angle bars, for domestic use.

Available for prompt shipment.

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We have a complete line of high-grade equipment, including—

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Dump Cars **Spreader Cars**

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Please send us your inquiries. It will pay you to do so.

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PRACTICALLY NEW

One Bucyrus Steam Shovel 70-C 2½ yard dipper, No. 1470, in excellent condition, practically new

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1—C. H. & E. Mfg. Co. No. 6 Saw Rig. 5 H.P. Gas engine with circular Band saws, etc. Steel Frame used one month.

1—Lidgerwood 3 drum, 35 H.P. 8¼ x 10 Bank Levers, Ohio Standard Boiler

1—Skid Derrick, Dobbie Irons, 50 ft. boom (new)

2—Stiff Leg Derricks

1—Owen Clam Shell Excavating Bucket.

1—Smith Concrete Mixer, Ohio Boiler, Side loader

1—4 yd. Dump Car (Koppel)

1—Page Drag Line Scraper Bucket, capacity 1 yd.

2—Haines bottom control Concrete Buckets, capacity 1 yd.

1—Insley two line bottom dump Bucket, capacity 22 cu.ft.

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For Sale Cheap

21 Koppel Cars
920 feet of Track
4 Switches

1 Carson Trench Machine, complete
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1 Aveling & Porter Steam Roller
2 500 gallon Tar Heating Wagons
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Also the following parts for No. 36 Symons Disc Crusher

1 Eccentric Box
1 Shaft and Ball
1 Steel Spider
1 Outer Disc
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These parts are brand new, never been used.

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1—¾-yd. Williams new

Clam Shell Bucket

2—½-yd.

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Good as new.

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2—Stationary plants, 2000 yds.
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Plant Foreman furnished.

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2½ tons—1 Pioneer, 1 Iroquois.
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8 tons—2 Kelly-Springfields.
10 tons—1 Buffalo-Pitts (Macadam).
Demonstration given.
Melting and dipping tanks.
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1¼ mile 24 in. industrial track, 20 lb. rail
1—7 x 12 Vulcan Steam Locomotive
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All in good condition, open to inspection and subject to immediate delivery. Closing out.

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STEAM SHOVEL
good, cheap for prompt cash.
DERRICKS
guy and stiff leg.
Contractors **DUMP WAGONS**, 1½ yard.

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Lidgerwood Cableway

1000 ft. span, with towers, engines 10 x 12.

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Contractor will sell

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at sacrifice, if purchased immediately.

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Model "E," shop No. 85, steam driven. Will sell cheap.

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1 Marion 36 traction, 1½ yd. dip.
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1—15 ton Browning
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100—4 yd. Western, 36 in. gauge
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5—10 x 16 Porter and Vulcans, 36 in. gauge
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2—13 x 18 Vulcans, 4 ft. 8½ in. gauge.

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7¼ x 10 Mundy Hoisting Engine with boiler

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Two, Pratt Boiler Feed Pumps
One Centrifugal Pump, gasoline driven

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3—Insley Chutes, 20 ft. long
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3—Insley Trucks for buckets
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1—Insley Roller Hoist Bucket

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Model 31 Marion Shovel, equipped with Drag Line and Dipper Sticks

All this material is in splendid condition and has seen very little service. The hoisting engine has never had fire in the boiler. We will sell all or any part of this equipment f. o. b. St. Louis, Mo. **FS276—Eng. News, Chicago**

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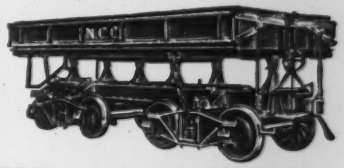

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12 yard **Hand Dump**
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CHICAGO PNEUMATIC H.S.G.

150 cu.ft. capacity. Gasolene engine driven. Mounted with Receiver on Steel Frame, on Wheels. Fine condition.

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and other lots of 16- to 75-lb. new and relaying rails at low prices, for immediate delivery.

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Parsons steam driven Model E. Shop No. 84. Good condition; cuts ditch 28 in. to 60 in. wide, and up to 20 ft. deep.

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1¼ yd., 33 ft. span, gasoline driven. Wickes make. First class.

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½ and ¾-yd. Clam-Shells—$2.00 Per Day.
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15 ton, 8 wheel Browning, 2 drums, 44 ft. boom.
10 ton Industrial 4 wheel, single line, 25 ft. boom

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40ft. —5 ton 3-Motor Shop Crane, Box Girders
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Rails, Derricks, Equipment.
Immediate shipment, reasonable prices.

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1—Ingersoll-Rand full Corliss steam-driven, 3600 cu.ft.
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Both machines absolutely new.

2—Ingersoll-Rand cross compound, steam and air cylinders, with Corliss valve gear, 3300-cu.ft. capacity. Boilers and condensers with this plant. All in good condition. Bargain.
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1—XB-2 Ingersoll-Rand belt-driven compressor 275 cu.ft. capacity, with 50 hp. G. E. Form "L" Motor, 3 phase, 60 cycle, 550 volts, speed 500 r.p.m. All complete with starting apparatus and belt; delivery March 1st.; in A-1 condition.
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1—165 KVA Crocker-Wheeler Generator 2300 volts, 3 phase, 60 cycle, 120 r.p.m. with exciter and switch board, direct connected to 10 in. and 20 in. x 36 in. stroke compound Harris Corliss Engine with Blake-Knowles Jet Condenser.
Excellent condition. Information upon request

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10—Electric Motors, 5—50 H.P.; 8,000 ft.— 1½ in., 1 in., ⅞ in., ¾ in., ⅝ in. Steel and Iron Rope.
2—McKiernan-Terry No. 2 Sheet Pile Hammers
100 pieces Lackawanna 10 in x 10 ft. Sheet Piling
Wrought Pipe from ½ to 20 in.

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Plant and Equipment used on construction of

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Shovels	Mixers
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Standard and narrow gauge Locomotives, Cars, etc.

All equipment overhauled in our shops and in first-class second-hand condition.

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Also Machines to Dig Open Drainage Ditches with Sloping Banks

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Second Hand Wrought Pipe

We carry a large stock of all sizes, furnished with perfect threads and couplings, sizes ¾ in. to 24 in.

Also a large stock of Hoisting Engines, Boilers, Air Compressors, Pumps, Tanks, Dump Buckets, Cars, Rails and Rock Drills.

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HOISTING ENGINES

IN STOCK—READY FOR DELIVERY.

1—10 in. x 12 in. D.C.D.D. skeleton "Lidgerwood"
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1— 6 in. x 6 in. dbl. vert. link motion "O & S"
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PIPE SECOND HAND

With new threads and couplings; also cut to sketch.

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2 Baldwin Locomotives, 36 in. gauge, 8 wheel; complete with tender; cylinder 15 in. x 18 in. Available at once.

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4 horizontal tubular, 72 in. x 20 ft., new grates and full flush fronts, 6 in. flues, riveted, good for 125—130 lbs.

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All Sizes—Guaranteed—Lowest Prices
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One horizontal eight inch discharge direct connected to 75 horse power steam engine.
Two vertical submerged four inch discharge extended shaft for well. Cutler Hammer Auto Starters and float switches, one hung from floor plate and other enclosed in elevating cage, connected to vertical motors, direct current.
One 1½ Kw. C. & C. D.C. Generator, 110 volts, belt driven.

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Large Contractor's Plant

consisting of Boilers, Cars, 36 in. gauge Locomotives, Derricks, Hoisting Engines, Jacks, Concrete Mixers, Pumps, Pipe, Small Tools, etc.

List gladly furnished upon request.

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STEAM SHOVEL

2½ yd. dipper. Ready for operation.

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FOR SALE, CHEAP

Complete Unloading Outfit

consisting of 7½-in. x 10-in. Lidgerwood engine, 4½-in. x 6-in. Mead-Morrison swinging engine (new), stiff-leg derrick, 40-ft. mast, 60-ft. boom, ¾-yd. Mead-Morrison bucket and cables. All in good running order.

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Greatest Experience is Embodied in the Construction of These Dump Wagons

The experience of nearly half a century in building earth moving machinery of practically every description is behind the Aurora and Austin lines of dump wagons.

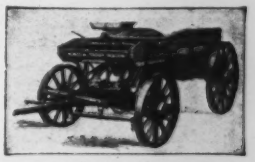
Longest use by most of the big contractors has demonstrated their efficiency, reliability and economy.

Aurora dump wagons are characterized by their rugged, practically unbreakable construction. Steel channels filled with wood compose the side frames. Slotted door hinges prevent binding when dumping. The top edges of the doors are strapped with iron making them sand tight.

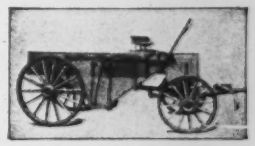
Austin stone spreader wagons are indispensable in the construction of macadam roads. They spread to the full width of the rear wheels and the distribution of the stone is under perfect control of the driver from his seat.

Built in sizes for every contractor and municipal requirement.

Write for complete catalogs of Aurora and Austin dump wagons.



Aurora Dump Wagon



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AUSTIN MANUFACTURING COMPANY, Chicago

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We Manufacture—Road and Elevating Graders, Scarifiers, Road Rollers, Quarry Cars, Dump Wagons, Stone Spreaders and Street Cleaning Machinery

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THE first to successfully introduce the internal combustion engine and the ability to do most work at least expense has made the Austin Motor Road Roller the standard in efficiency and economy.

Dispensing with the danger and annoyance of the smoke and fire of a steam roller, eliminating expensive hauling of coal and water, ease of control, and the ability to operate on either gasoline or kerosene are among the reasons for this superiority.

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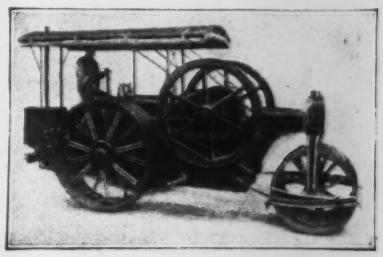
Branch Offices—New York City, Columbus, O., Philadelphia, Atlanta, Dallas, San Francisco, Los Angeles, St. Paul.



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STANDARD EVERYWHERE

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Bridges Buildings Structural Steel

Engineers, Fabricators, Erectors of Steel Railroad and Highway Bridges. Structural Metal Work of every description.

Read Page 2

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Quicker and cheaper than a gasoline blow-torch for brazing and soldering.

For factories and repair shops the Prest-O-Torch saves time and money. Used with Prest-O-Lite Tanks—ready-made gas. Safe and convenient. Style "A," price 75c (Canada, 85c.) will braze up to ¼ inch round rod. Style "C" for heavier work, $2.25 (Canada, $2.75). Write for literature.

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The design and manufacture of machinery for the economical handling of bulk material and manufactured products has been our mission for more than forty years. A great many power plants—industrial plants—railroads—steamship terminals, etc., have profited by conferring with our Engineers. They are ready to serve you.

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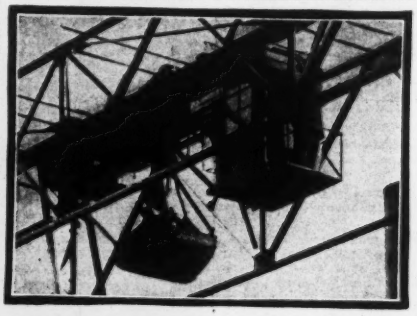

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For handling ore, coal, sewer digging, excavating, foundation work, dredging, sand and gravel mining, sand handling and the handling of all bulk materials.

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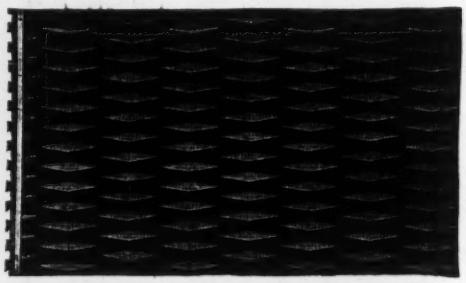

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For Sewers, Aqueducts.—Drains, Subways, Tunnels, Bridges, Piers, Locks, Dams, Walls, Columns, Manholes, Roads, Curbs, etc.

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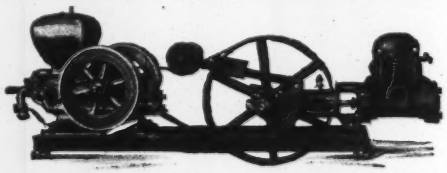

2235

Single Style Double Acting Power Pump, driven by gas engine. This makes a very compact pumping outfit for general service.

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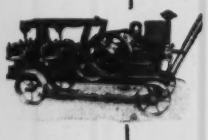

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in delivery, material, and workmanship on penstocks, tanks, smoke-stacks, draft tubes, and all kinds of plate and structural steel.

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Triplex Power Pumps in several hundred styles and sizes and in addition more than a thousand Rotary, Centrifugal and Deep Well Pumps and Hand Pumps of all kinds.

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was established in 1884. Our contract test boring department is at your disposal for locating your dam or bridge sites.

Booklet 4115

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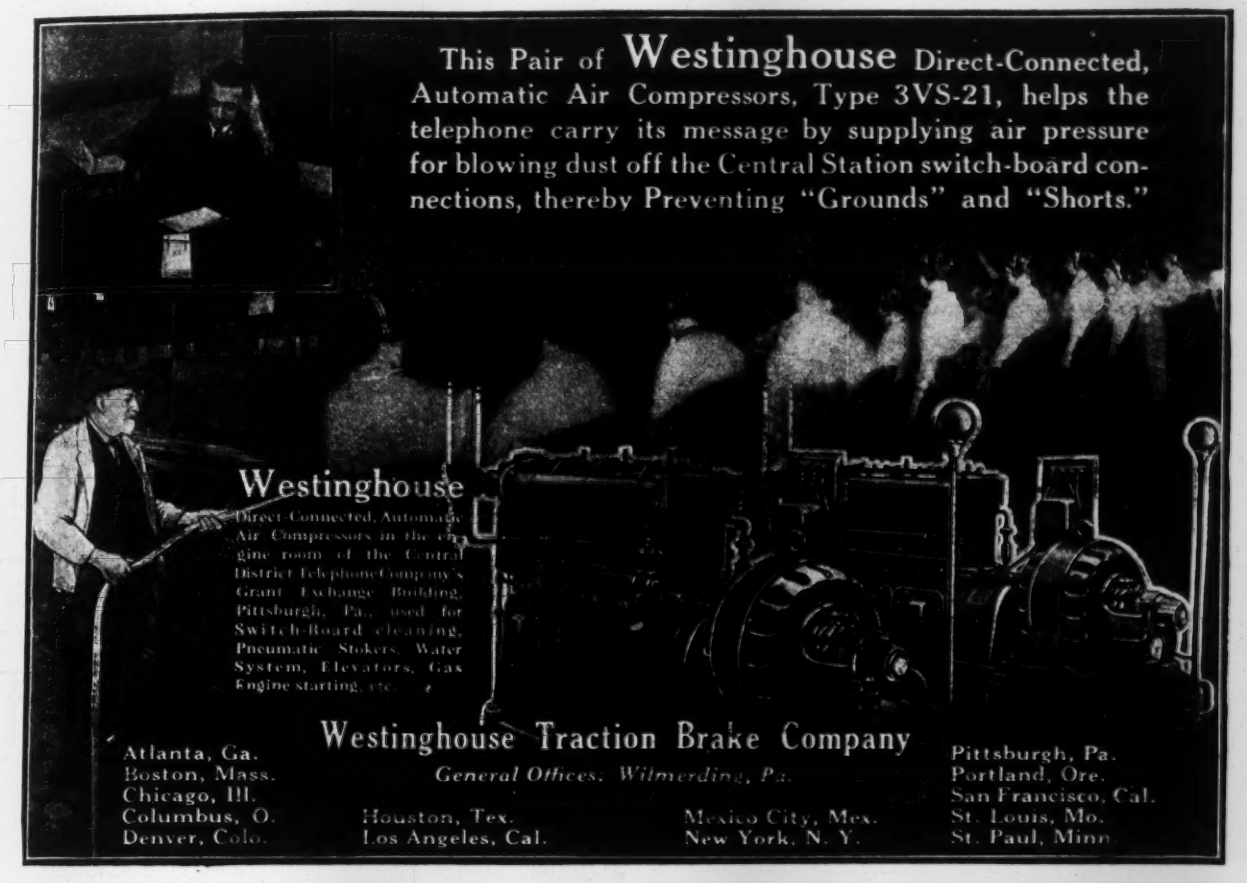

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Westinghouse

Direct Connected, Automatic Air Compressors in the engine room of the Central District Telephone Company's Grant Exchange Building, Pittsburgh, Pa., used for Switch-Board cleaning, Pneumatic Stokers, Water System, Elevators, Gas Engine starting, etc.

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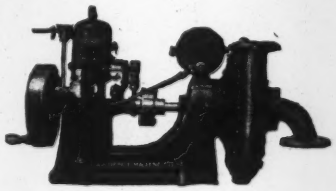
Pumping Machinery



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Our engineering department is at your service to help you obtain better pumping economy.

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The Junior Trench Pump will lift water containing sand, gravel or sewerage. Can be operated for 7 hours on 1 gallon of gasoline with a capacity of 3,500 gallons per hour. Built for hard service. Any diaphragm pump can be fitted to the outfit.

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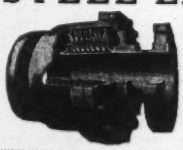

The test of time proves the chrome vanadium steel construction used.

Good for steam or hot water up to 200 pounds.

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Increase capacity of boilers, give more power with less fuel, and prevent all loss and trouble due to wet steam.

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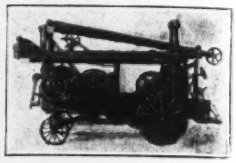
for Heavy Service in elevating large quantities of water from deep artesian wells. Catalog 6.



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Drive Your Generator With a Samson Turbine

You can save money if you will use a Samson to drive your generator because the Samson attains a quicker speed than any other turbine operating under the same conditions. This allows the use of lighter and consequently lower priced transmission machinery.

Samson Turbines use the water economically; the speed is quick and steady; they develop great power. Write us today.

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Felton's Improved Couplings for Conduit and Sewer Rods

These Couplings represent the latest and most improved device for connecting sewer and conduit rods. No other coupling possesses so many strong features of merit.

Some of the Users of Felton Patent Couplings

For Rodding Conduits: Electric Light Companies, Contractors, Street Railway Companies, Police and Fire Alarm Signal Systems, Telephone Companies.

For Cleaning Sewers and Drains: City Engineers, Contractors, Sewer Departments, also Schools, Hospitals, Asylums, Army Posts, Barracks, Railroads, Corporations with Independent Sewer Systems. **Send for circular and prices.**

HAROLD L. BOND CO., 383 H Atlantic Ave. Boston

Manufacturers of

Ross Concrete Spade, Andrews' Concrete Tamper, Safety Trench Braces, Felton's Sewer and Conduit Rods, Pearl Brand Suction Hose and Atlantic Pumping Engines.

THE STREAM IS CONTINUOUS

The economy of the Nye New Model High Pressure Pump is based upon its unfailing ability to continually discharge a great amount of solids—at a higher elevation than any other pump on the market. Pumps water, sewage, coal, sand, hair and crushed rock or malt. **Send for Catalog No. 14.**

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Hydraulic Dredges—Pumping Engines

Our line is complete and your needs will be served promptly. Write us your requirements.

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Are you wasting time with a wrench that slips off the nut? Use the **Favorite** reversible ratchet **Wrench.** It grips the nut on all sides.

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THE PENN COUPLER

OUR latest development of the M. B. C. Coupler, a modification of our popular Pitt and Janney "X" Couplers, with latest improvements. **"Lock-to-the-Lock," "Lock-Set"** and **"Knuckle-Opener." Send for blueprints and prices.**

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Edson Diaphragm Pumps

Operated by Man or Gasoline Power

will handle Sand, Mud, Gravel, Sanitary Deposits and anything limpid enough to flow, without clogging or injury. *Send for Descriptive Catalogue.*

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All kinds of repairing while chimney is in use.

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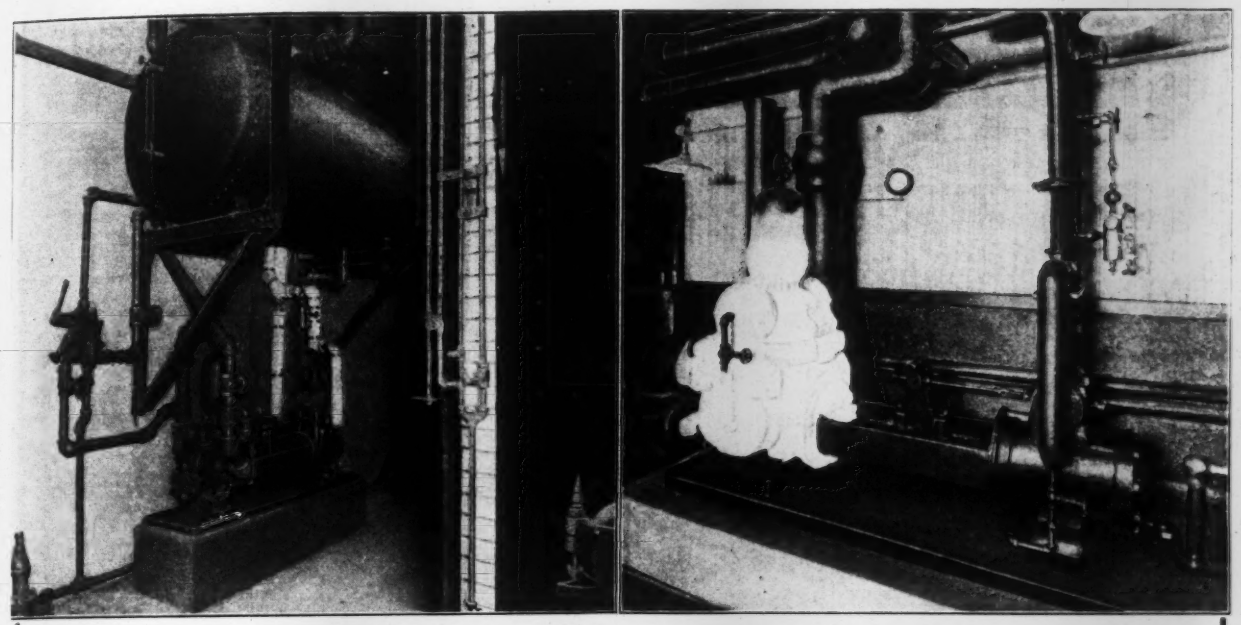

View in Boiler Room, Castle Square Hotel, Boston, Mass.

BLAKE-KNOWLES

Style "A" Simplex Pumps

in the power plant of the Castle Square Hotel, Boston. One feeds two 200 H. P. boilers—the other feeds a Linde Ice Machine

In the fire room of the Castle Square Hotel, Boston, is a Blake-Knowles Horizontal Simplex Style "A" Boiler Feed Pump of the piston type, size 7½x4½x10. It runs continuously, night and day, and feeds two 200-H.P. Babcock & Wilcox boilers carrying a steam pressure of 100 lb. The picture shows pump arrangement, overhead tank from which the returns from heating coils, drains, etc., are pumped back to the boilers.

The pump will do its work with a total steam consumption of only 242 lb. steam per hour, which for a pump of this small size is a showing that we don't mind talking about. This pump is now working at about two-thirds normal rated capacity; at full capacity it will make even a better record.

The right hand picture shows a Blake-Knowles Simplex Style "A" Brine Pump, size 10x12x12, which the Castle Square Hotel uses for circulating brine in connection with a Linde Ice Machine. The pump is one of the latest Blake-Knowles Simplex Style "A" models and operates against a head of about 40 lb. per square inch. This pump has been in active service for about two years, running continuously and with practically no attention, without repair and shows no sign of wear. It has given noteworthy service in the matter of economy and has been eminently satisfactory from the start.

The reason for the economical showing, in all Simplex Style "A" Pumps, and greater figures than the above for larger capacity pumps of the line, lies—in simple but intelligent design—few wearing parts, stuffing boxes, and packings required—careful construction—reduced amount of steam cylinder condensation—and last, the fact that short stroking *cannot* occur under any conditions of running.

It will be worth your while to investigate the Blake-Knowles Style "A" line of pumps. Let us help you do it.

Bulletin BK-876-19 will be sent on receipt of your name and address.

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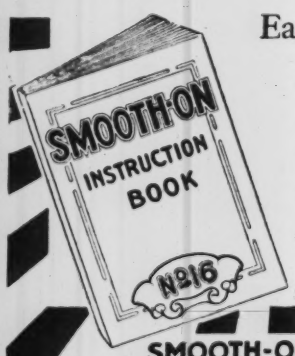
IRON CEMENT NO. 5

For making hub joints on cast iron soil pipes, gas and water mains.

Easy to apply.



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24 John Street - - - New York
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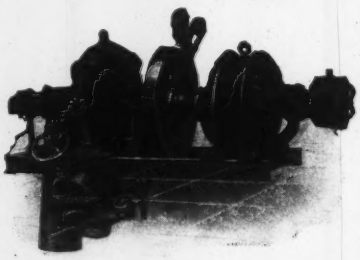

of this particular type installed recently in South America.

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Is easily assembled and especially adapted for plants remote from railroads.

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for elevating sewage from deep basements in city buildings.
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Standard Oil Engine directly connected with **Morris Pumps.** 4-in. suction, 3-in. discharge, 22-ft. head, 250 gals. per min.
Standard Oil Engine Co., Bridgeport, Conn.

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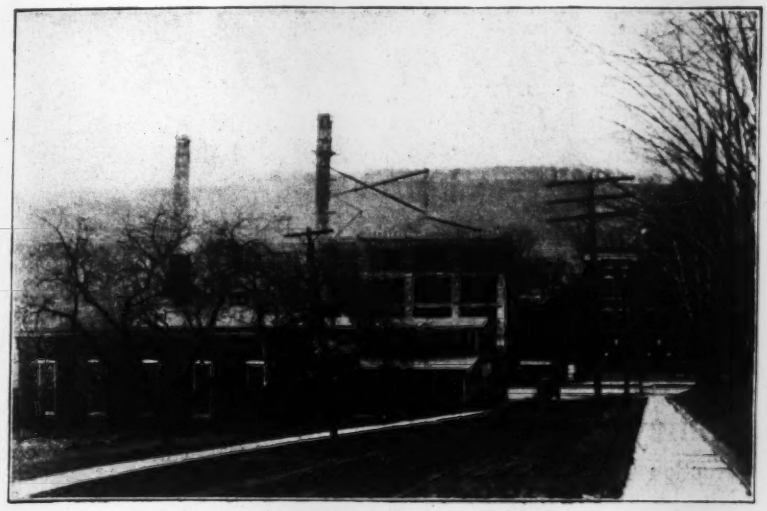
Insley Concrete Gravity Plants



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This completely eliminates the trouble and expense incidental to the shifting of chute lines and results in low unit costs for the placing of concrete.

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Outwears rubber hose 10 to 1—as flexible but 30% lighter.
Write for booklet.
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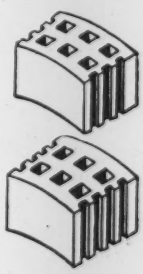

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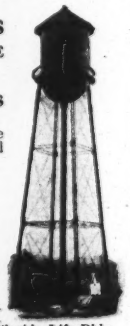

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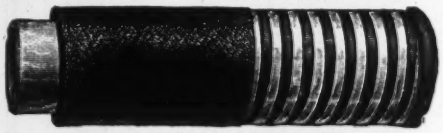

It Carries More Water for its Diameter Than Any Iron Pipe

WYCKOFF WOOD PIPE is not impaired by the effects of electrolysis acid fumes or corrosion.
It is light, strong and very durable. Lengths, 6 ft. to 12 ft. long.
Size for size, it carries 14% more water than iron pipe.
Costs less for transportation because it is lighter and easier to handle.

May we send Catalog giving fullest details?

A. Wyckoff & Son Company, Elmira, N. Y.
378 Piedmont Ave., Atlanta, Ga.
Established 1855
Johnson-Peters Co., Pittsburgh Terminal Warehouse, Pittsburgh, Pa.
551 West 14th Place, Chicago, Ill.

Wood Stave Pipes Have Low Construction Costs

Built at the job—save freight and handling charges.

Joints need no expensive caulking. Pipe easily tapped.

Our engineering department is at your service to help solve your hydraulic problem.

Pacific Coast Pipe Co., Seattle, Wash.
Manufacturers of Machine Wire-Wound and Continuous Stave Wood Pipe.

Piping Facts

of interest are contained in the Washington P. & F. Co.'s book. The knowledge of experts has gone into it—men who have a means of solving the piping difficulty that perchance now confronts you.

Today is a good day to send for your copy.

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1512-1620 Center St. and 3001-3019 Asotin St., TACOMA, WASH.
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Portland is the Perfect Pipe

Made of the finest old growth Oregon or Douglas Fir, Portland Wood Pipe is cheaper than iron or steel pipe yet of greater efficiency.

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Manufacturers of

CAST IRON PIPE
SPECIAL CASTINGS

Bell and Spigot — Flanged — Flexible Joint — Culvert — Tubes, Milled and Plain Ends — Cylinders — Manhole Heads and Covers—High-Pressure Fire Service Pipe—All Sizes.

Sales Office: 11 Broadway, New York : Works: Phillipsburg, N. J.

"More Than Ever" NATIONALly Prepared

EXPOSED INSTALLATIONS

¶ When a pipe installation is exposed, the chances of accident are far greater than when buried deep in the earth. Great boulders frequently crash down a mountain side into the valley across which a pipe line runs.

¶ What happens when a great boulder hits ordinary pipe? "NATIONAL" Pipe may be bruised, but is not broken in the encounter.

¶ See the double page-announcement in next week's issue for the effect of a CRASH!

NATIONAL TUBE COMPANY, PITTSBURGH, PA.

American Pipe and Construction Co.

Water Works Engineers and Contractors
112 North Broad Street, Philadelphia
Also Manufacture
Welded Wrought Iron Pipe, Lined and Covered with Pure Cement and Having Lead Caulked Bell and Spigot Joints
The only noncorrosive pipe on the market good for any pressure

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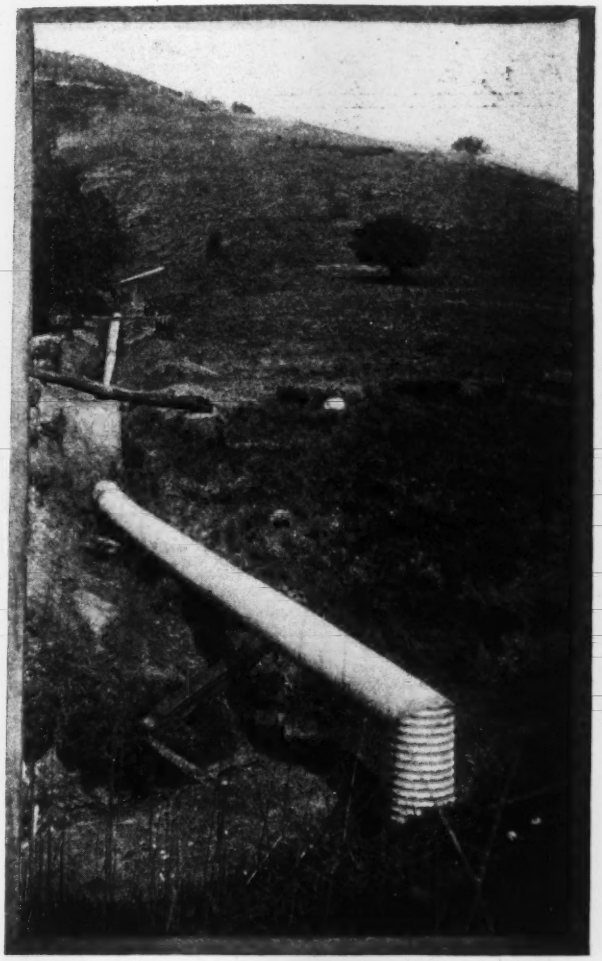
Mathews' Single and Double Valve Gate Valves — **FIRE HYDRANTS** — **Valve Indicator Posts**

Manufacturers of All Kinds and Sizes of CAST-IRON PIPE



Quite Significant!

AMERICAN ARMCO INGOT IRON

Resists Rust

There are three very significant facts tied up to this picture.

First, note that considerable head of water is to be handled—requiring strength in the line.

Second—look at the right angled bend—see how easily it has been made—money was saved on that job.

Third—the hidden qualification—a lasting job at moderate cost.

"Armco" Iron Culverts were decided on for this work because they met *all* qualifications with the best economy.

ARMCO IRON Resists Rust

By special care in manufacture great success is attained in driving out the gases, as well as the solid impurities, and Armco (American Ingot) Iron is left a highly pure and uniform material.

It is safe on difficult work—and in service is really cheap in dollars and cents.

Any of the manufacturers listed below will gladly furnish you with prices and particulars on "Armco" Iron Corrugated Culverts, Flumes, Sheets, Roofing and Formed Products. Write to the concern nearest you.

Arkansas, Little Rock
Dixie Culvert & Metal Co.
California, Los Angeles
California Corrugated Culvert Co.
California, West Berkeley
California Corrugated Culvert Co.
Colorado, Denver
R. Hardesty Mfg. Co.
Delaware, Clayton
Delaware Metal Culvert Co.
Florida, Jacksonville
Dixie Culvert & Metal Co.
Georgia, Atlanta
Dixie Culvert & Metal Co.
Illinois, Springfield
Illinois Corrugated Metal Co.
Indiana, Crawfordsville
W. Q. O'Neall Co.
Iowa, Des Moines
Iowa Pure Iron Culvert Co.
Iowa, Independence
Independence Corr'g'd Culvert Co.
Kansas, Topeka
The Road Supply & Metal Co.
Kentucky, Louisville
Kentucky Culvert Mfg. Co.
Louisiana, New Orleans
Dixie Culvert and Metal Co.
Maryland, Baltimore
W. M. Baker, Munsey Bldg.
Massachusetts, Palmer
New England Metal Culvert Co.
Michigan, Bark River
Bark River Bridge & Culvert Co.
Michigan, Lansing
Michigan Bridge & Pipe Co.
Minnesota, Minneapolis
Lyle Corrugated Culvert Co.
Minnesota, Lyle
Lyle Corrugated Culvert Co.
Missouri, Moberly
Corrugated Culvert Co.
Montana, Missoula
Montana Culvert & Flume Co.
Nebraska, Lincoln
Lee-Arnett Co.
Nebraska, Wahoo
Nebraska Culvert & Mfg. Co.
Nevada, Reno
Nevada Metal Mfg. Co.
New Hampshire, Nashua
North-East Metal Culvert Co.
New Jersey, Flemington
Pennsylvania Metal Culvert Co.
New York, Auburn
Pennsylvania Metal Culvert Co.
North Dakota, Wahpeton
Northwestern Sheet & Iron Wks.
Ohio, Middletown
American Rolling Mill Co.
The Ohio Corrugated Culvert Co.
Oklahoma, Shawnee
Dixie Culvert & Metal Co.
Oregon, Portland
Coast Culvert & Flume Co.
Pennsylvania, Warren
Pennsylvania Metal Culvert Co.
South Dakota, Sioux Falls
Sioux Falls Metal Culvert Co.
Tennessee, Nashville
Tennessee Metal Culvert Co.
Texas, Dallas
Wyatt Metal Works
Texas, El Paso
Western Metal Mfg. Co.
Texas, Houston
Lone Star Culvert Co.
Utah, Woods Cross
Utah Corrugated Culvert & Flume Co.
Virginia, Roanoke
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Spokane Cor. Culvert & Tank Co.
Wisconsin, Eau Claire
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Canada, Canada Ingot Iron Co., Ltd., Guelph, Sherbrooke, Winnipeg, Calgary.

Extreme Accuracy Through a Wide Range in Rate of Flow

The practically frictionless rise and fall of the float sealed in mercury upon which the operation of the

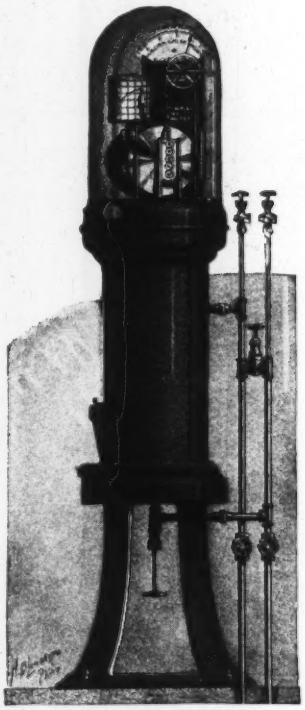
SIMPLEX
Indicating and Recording Meter

depends, enables it to respond accurately to small velocity heads even as low as 1-64th of a foot.

This float has its inner surface shaped to a curve generated so that vertical movements are directly proportioned to velocity—thus doing away with the friction of all cams and integrating devices.

Hence there is required a miminum pressure difference in the tube, which accordingly can be made with the largest throat. The friction loss is, therefore, less than in other Venturi tubes, resulting in a material saving in power.

Leading water works have installed Simplex Meters to guide the economical operation of both gravity and pressure distribution. Write us for interesting Bulletins.



Simplex Valve & Meter Company

625 Wood Street **Philadelphia, Pa.**

New England Representative—Geo. W. Stetson, 141 Milk St., Boston, Mass. **Pacific Coast Representatives**—Water Works Supply Co., San Francisco and Los Angeles.

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Keystone and Eureka
Water Meters

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Pittsburgh Meter Co.
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KANSAS CITY

Clean Water Mains
Deliver Full Capacity

We are glad to confer with municipal officials or Water Companies.

National Methods are patented

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RECORDING INSTRUMENTS

For Pressure, Temperature, Electricity, Motion, Humidity, Etc.

Awarded the Grand Prize, Panama Exposition, 1915

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Hydraulically and Electically Operated Valves and Sluice Gates Valves Designed for all Kinds of Service.

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Cast-Iron Water, Gas and Flange Pipe, Special Castings, Fire Hydrants, Valves, General Foundry and Machine Work.

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For Municipal and Industrial Purposes.

Licensed For "Down Draft or Negative Head."

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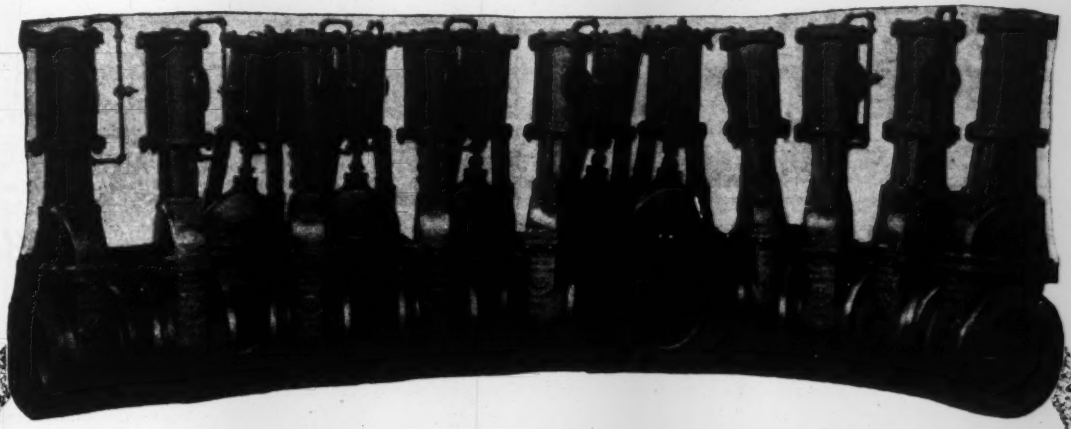
WATER FILTERS for Municipal and Industrial Plants. Gravity and Pressure Types.

CHEMICAL DEVICES



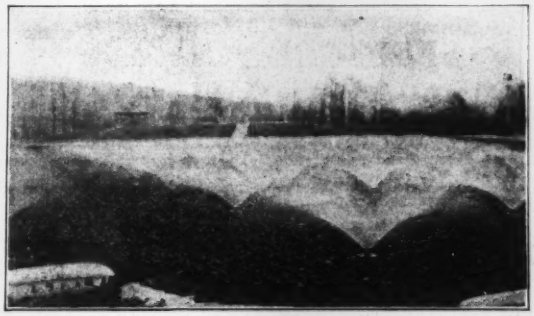
For Filtration Service Specify Kennedy

Then you will be sure of getting RELIABLE valve service. Back of Kennedy Valves stands a strong organization that has specialized in valve manufacturing for 40 years. A group of Kennedy "Newtype" Hydraulically-Operated, Double Disc, Parallel Seat Gate Valves are shown here. They were built for filtration service. These valves will operate in any position—an important point to remember.

Details are not necessary here. The 126-page Kennedy Valve Book contains complete information and should be in the hands of all municipal engineers and water works superintendents. Sent on application.

Kennedy Valve Mfg. Company

Elmira, N. Y.



Sewage Disposal Plants Completely Equipped with Pacific Flush-Tank Co.'s Apparatus

are the standard accepted by cities and towns throughout the country. The above photograph shows Taylor nozzles spraying sewage, operated by 24-in. trapless Miller sewage siphons, the dosing tank being arranged to supply a sufficient volume at each dose to properly cover the stone filter bed.

The sewage for this plant is treated in Imhoff tanks, and flows to the dosing tanks. Then through the Miller siphons and distribution piping, and by means of the Taylor circular type of nozzles, is sprayed over the filter beds. Plant at Plainfield, N. J.

Engineers are invited to write for a complimentary copy of Catalog No. 14, which is a treatise on Sewage Disposal Equipment.

PACIFIC FLUSH-TANK CO.

4241 Ravenswood Ave., Chicago, Ill. Singer Bldg., New York

United States and Canadian Commercial Representatives of Dr. Karl Imhoff's Patented Tanks.

Tycos Temperature Instruments

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To meet the requirements of those innumerable processes requiring exact indication, measurement and regulation of temperature, we have developed *the most practicable and reliable* instruments that can be found.

H&M Type Angle and Straight Stem Thermometers

Recording and Indicating Thermometers

Automatic Temperature and Pressure Regulators

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Engraved Stem Thermometers

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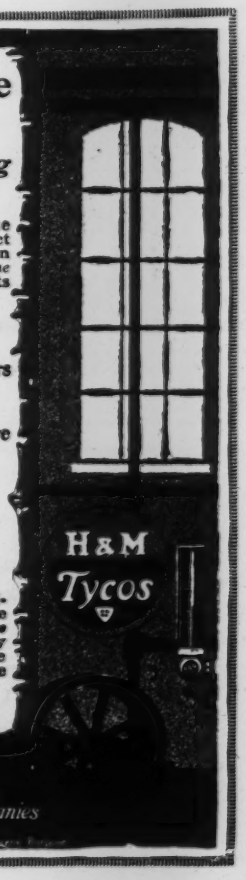
Our more than fifty years of experience as makers of high grade, accurate instruments assures you that the *Tycos* products are as *different* from ordinary instruments as unusual skill, great care and the highest standard of manufacture can make them.

Let us work with you to secure the results you should have. Over half a century of TYCOS experience will thus be at your disposal.



The H & M Division
Taylor Instrument Companies
ROCHESTER, N.Y.

GRAVITY and PRESSURE FILTERS

Hypochlorite Apparatus and Water Softening Plants.

Send for Bulletin 15-2

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FOR THE FINE GRINDING OR PULVERIZING OF ANY MATERIAL —AS FOR EXAMPLE—

Asbestos	Carbon	Coal	Hard Rubber	Marble Dust
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THE RAYMOND BROTHERS IMPACT PULVERIZER CO., 1313 N. Branch St. CHICAGO, ILL.

Current Velocity Measurement

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assures you of accurate and dependable results under all conditions.

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FREIGHT and PASSENGER
CARS
OF EVERY DESCRIPTION

CASTINGS—FORGINGS—WHEELS
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Norton Self-Lowering Jacks are the Fastest Jacks Made

They lower the full load with absolute safety by pressing the button—you do not have to pump or crank them down as with other jacks.

25 to 100 tons capacity—Plain and with foot lift. Send for complete illustrated catalogue No. 29.

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Shear, Flap and Butterfly Valves
FLEXIBLE JOINTS
COLDWELL-WILCOX CO
NEW WINDSOR NEWBURGH N.Y.

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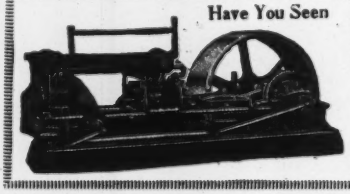
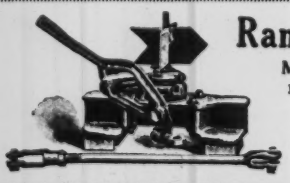


The Norwalk Motor-Driven Compressor?

Full Load, Part Load, No Load, according to demand.

Don't be satisfied with the "as good" kind. Get "IT!"

The Norwalk Iron Works Co.
South Norwalk, Conn.



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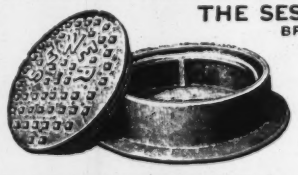

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SEWER and SUBWAY MANHOLE CASTINGS
Sewer Catch-Basin Castings, Etc.
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Our bulletins describe the successful solution of many materials-handling problems. Let them help you.

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BUCHANAN All-Steel Crushers
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Crushing Plants complete in all details from 100 to 5,000 tons daily capacity.

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Our Contractors' locomotives are built by men of skill and judgment in design, whose specialty is the building of locomotives for every kind of hauling.

These locomotives are of the same high grade as those built for the standard railroads. This high quality of material and workmanship insures long continuous service. This means high earning capacity.

All the parts are made in jigs and are absolutely interchangeable between locomotives of the same size and design. Duplicate parts are kept in stock, which cuts out long delays when replacements are necessary.

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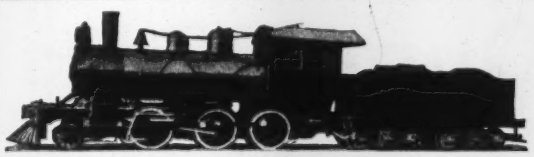
Dominion Express Building, Montreal, Canada.
N. B. Livermore & Company, San Francisco and Los Angeles, California.
Northwestern Equipment Company, Seattle, Wash., and Portland, Oregon.



Whatever your hauling requirements, we can supply you with a
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that will fully meet them.

Made in many types and all sizes, suitable for long or short hauls, high speed or slow, heavy hauling. In all classes of work—railroad, construction, plantation, industrial, etc.—Vulcan Locomotives are giving the very highest kind of service.

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Made by the J. D. Fate Co.

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The Compressed Air Method
123 West Madison Street, CHICAGO, ILL.
Tunnel Lining Equipment — Heavy Concrete Work

Two Plymouth Trains Meeting on Steep Grade En Route

"We Haul Our Gravel 2½ Miles at 5c. per Yard"—
Says Mr. Sullivan

Phelan & Sullivan, contractors of Syracuse, N. Y., built the Syracuse-Bridgeport state highway. There was a haul of gravel from pits to point of use 2½ miles—and Phelan and Sullivan hauled their gravel at a cost of 5c. per cubic yard, which was twice as cheap as steam or horses ever did.

The Plymouth
Friction-Drive Gasoline Locomotive
Cuts Haulage Costs One Half

1. The Plymouth costs less to **buy** than any other locomotive, as its price is 1-3 to 1-2 less.
2. It costs less for **labor** operation, as any ordinary day-laborer can run it.
3. It costs less for **fuel**, as the 3-ton size, like P. & S. bought, consumes less than 5 gals. gasoline per 10 hours.
4. It has less **engine** trouble, as the "Continental" motor (the best to be had) is used.
5. It costs less for **lubricants**, as the Friction-Drive requires none and Hyatt Roller Bearings are used.
6. It **hauls** greater loads, because the Friction-Drive gives full motor power at ALL speeds.
7. It takes **higher grades** because the Friction-Drive permits starting off with load under FULL power.
8. It costs less for **repairs** because it is simpler in construction than ANY other locomotive.

Mr. Sullivan Proves These Statements—

"The two Plymouths make ten trips each day with 9-yard cars, making a total of 270 cubic yards of gravel per day," writes Mr. L. D. Sullivan. "The cost of operation is $13.50 for labor, gasoline and oil, which is, approximately, 5c. per cubic yard."

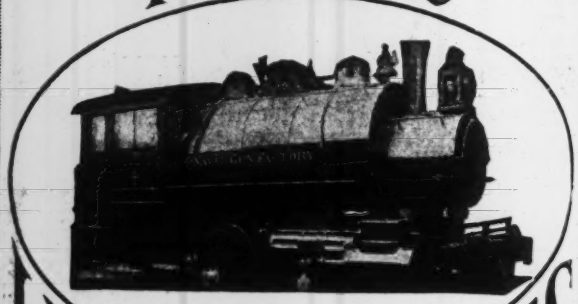
THIS BOOK TELLS—

Hundreds of Plymouths are cutting haulage costs in sand, gravel and clay pits, in stone quarries, road construction work and wherever haulage between two fixed or temporary points are required. YOUR case is no different from these. Make us prove The Plymouth IS cheaper than horses or any other haulage system.

We have a big, little book that not only gives the full story of the Phelan & Sullivan case, but 34 other installations with cost data, wave-line charts, pictures and other interesting information. A copy is yours for the asking.

The J. D. Fate Company
206 Riggs Ave. Plymouth, O.

PORTER



LIGHT LOCOMOTIVES

You cannot find their equal for strength, power, quality, weight and durability. They are a good investment, guaranteed in every particular and made in every variety of size and design, for any gauge of track.

Go over the question of Locomotives with us. Write for prices. Porter Locomotives are distinctive in quality and efficiency.

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New York Representatives, Wonham, Bates & Goode, Inc., 17 Battery Place.

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For Rent **For Sale**

V-shape, Square Box and End Dump Cars, all types and sizes. Locomotives, Portable Track, Steel Ties, Turnouts, Switches, Rails, Frogs, etc.

New or second-hand equipment on hand for quick shipment.

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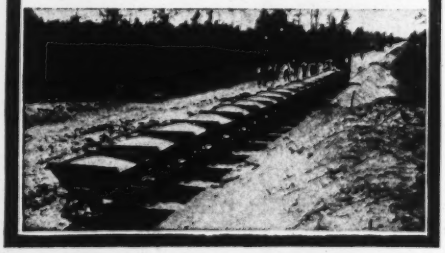

Continental Dump Cars

Built Better Than Ever

For staunch construction, quality of materials used, general all round serviceability and satisfaction, they challenge all competition.

We build all sizes and types of industrial cars for any specific requirement. Write us concerning your needs.

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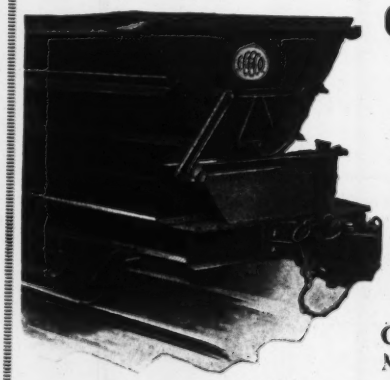
Makers of Continuous, Weber, Wolhaupter and 100% Rail Joints. Standard, Insulated, Step, Frog and Switch Types.

Protected by Patents. Grand Prize, San Francisco, 1915.

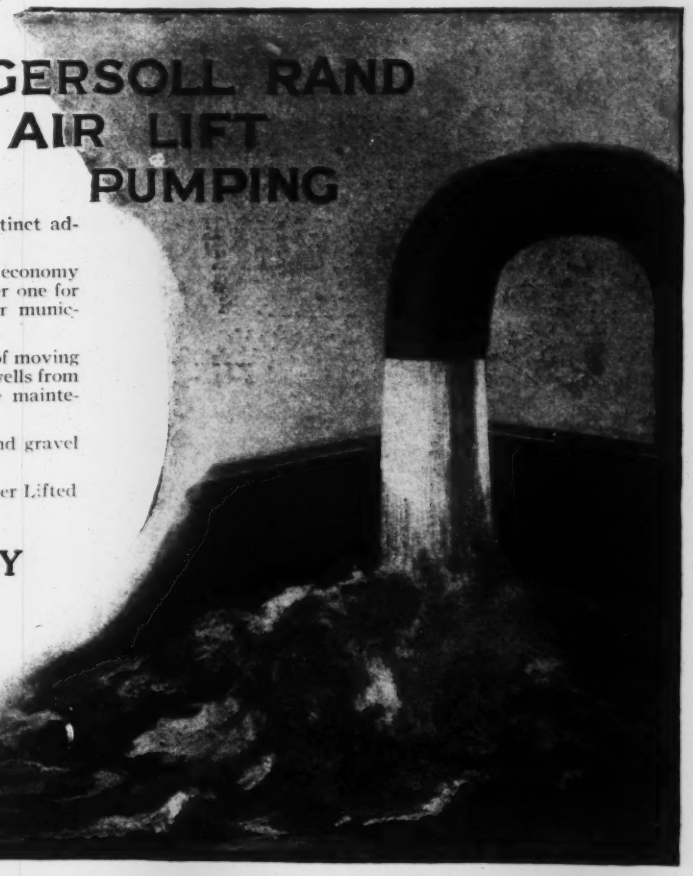


Contractor's Car

This is our standard type. But we build all styles of industrial cars, made of either wood or steel, or steel and wood combined. Our 56-page illustrated catalog will give you some idea of the quality and extent of our line. **Ask for Catalog 706.**

Easton Car & Construction Co.
New St., Easton, Pa.

Water in Any Quantity at a Reasonable Cost



The Air Lift system of pumping from deep wells has distinct advantages in small as well as large installations.

You can pump with the assurance of great reliability and economy whether the installation is a relatively small one or a larger one for irrigation or other industrial purpose, or a very large one for municipal supply.

The extreme simplicity of the well equipment, the absence of moving parts in the well, and the ability to pump widely scattered wells from one central power plant are factors which keep down the maintenance cost.

An Lift pumping aerates and purifies the water. Sand and gravel do not interfere with nor impair its operation.

Everyone interested in deep well pumping should read "Water Lifted by Compressed Air." It's free. Send for a copy.

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AIR COMPRESSORS **ROCK DRILLS**
PNEUMATIC TOOLS

60-M

Now comes a weed killer worthy of the name. It's

TRACKOLINE
KILLS EVERY WEED TOP ROOT & SEED

And if you are bothered with a weed-choked right of way "Trackoline" will prove its right to that title—rest assured of that!

For experiment take a certain portion of the track. Saturate it with "Trackoline" in accordance with the instructions we will furnish—

Then watch the weeds disappear.

Understand, no costly equipment will be necessary for applying; no injury to rails, ties or other parts of the track superstructure; no harm to live stock—

"Trackoline" will dispose of the weeds—that's all.

The circular which gives its complete description is yours for the request.

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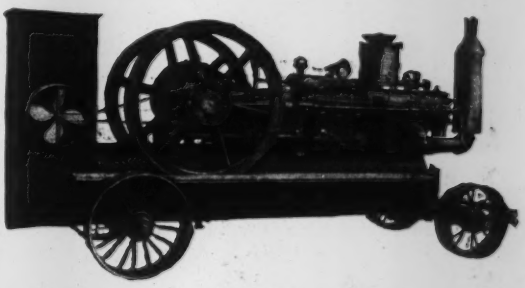

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This "one man" machine has demonstrated its all 'round superiority and wonderful adaptability in all classes of sinking and tunneling.

So sturdy is its construction that it keeps underground in the heaviest service, yet it is light enough to be used unmounted for down holes.

Economical of power and repairs, this speedy machine is a favorite with the men. When the steel is binding or runs into a slip, the hole is not lost; for the drill may be cranked back while running with the full force of rotation, without any danger of breakage.

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Contractors Complete Plants Designed and Furnished—

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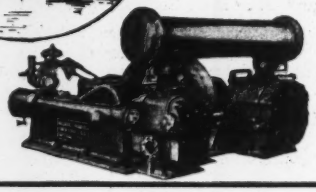
Steam and motor-driven; straight line, duplex and compound—we have them of highest grade. Rock and well drills also. Our service will help you immeasurably—take advantage of it—today.



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Selling Agents for High-Efficiency Equipment.

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This light, durable machine will be sent on approval for 30 days' trial. If not as represented, send it back.

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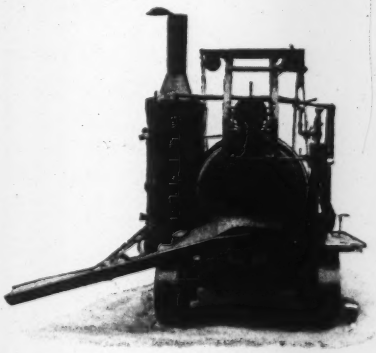
Your Profits are Sure When You Use Marsh-Capron Mixers



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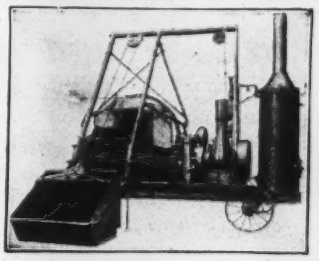

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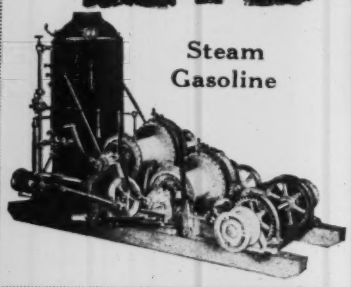
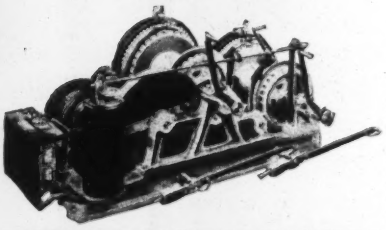


Electric—Belt



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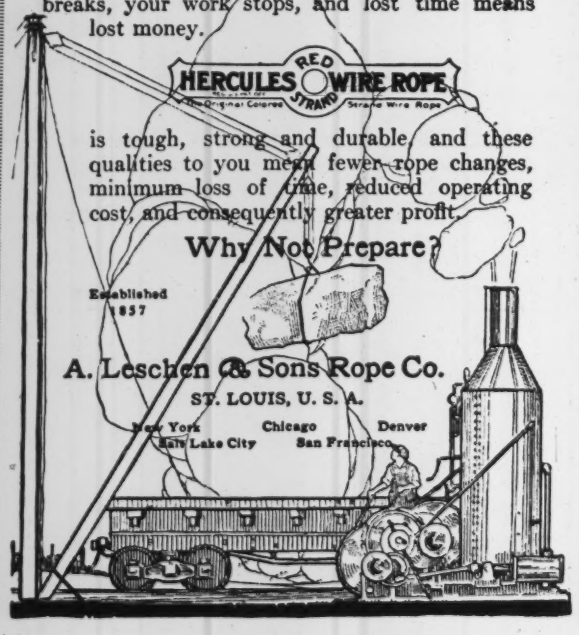

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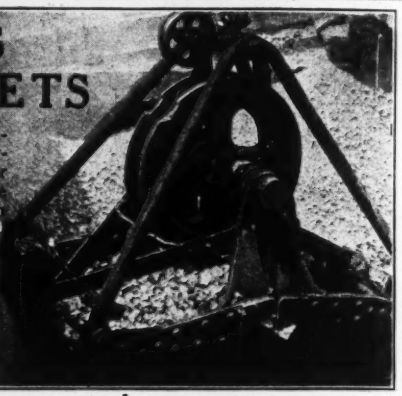

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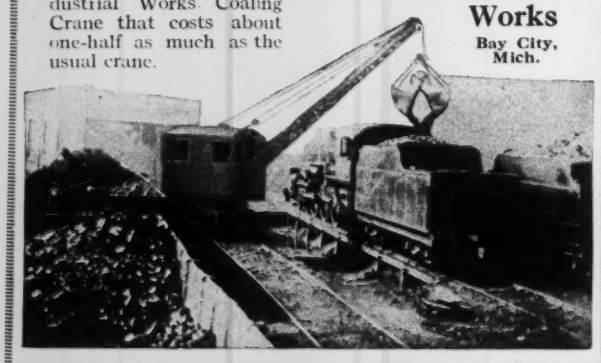

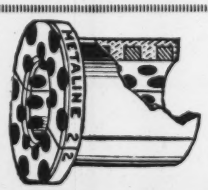

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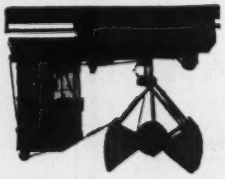

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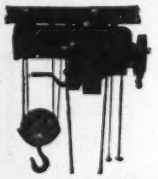

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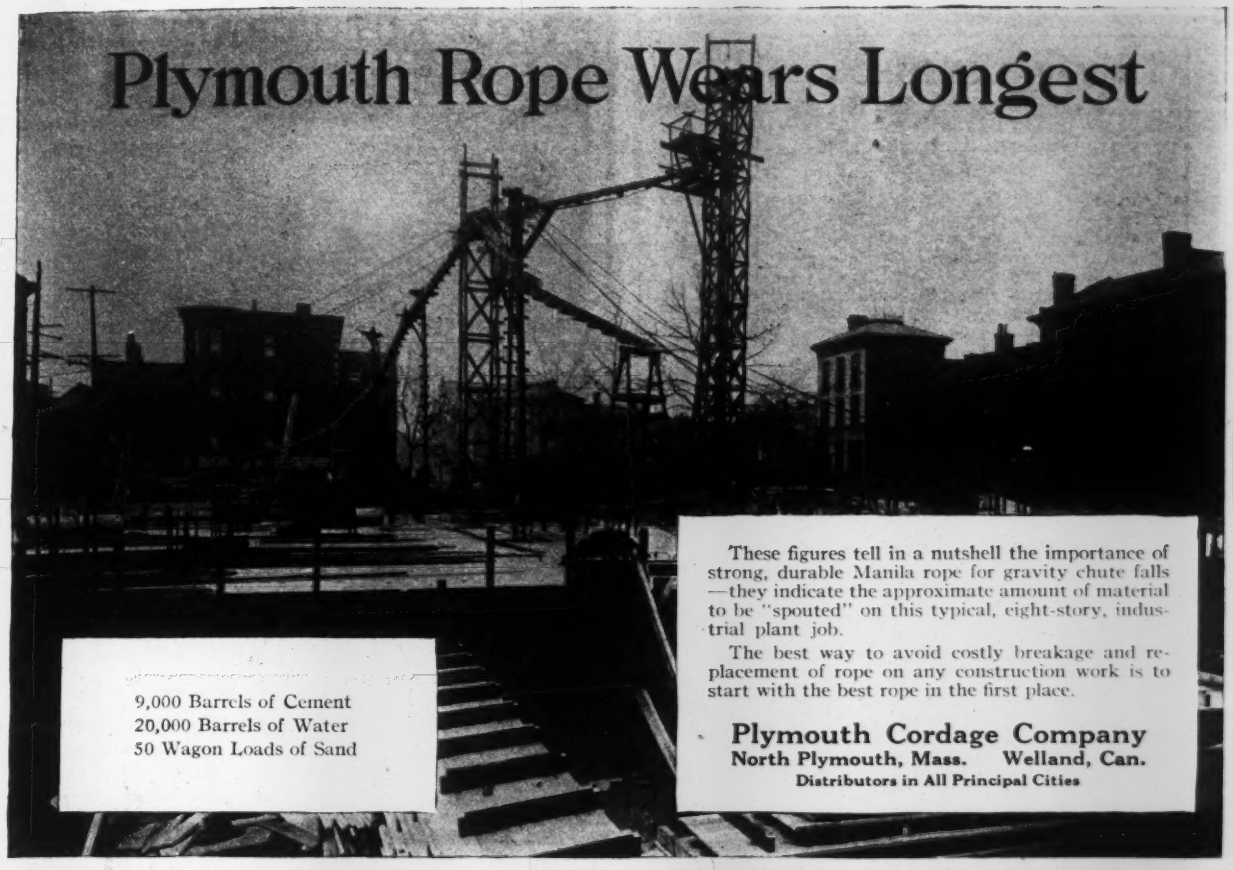

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50 Wagon Loads of Sand

These figures tell in a nutshell the importance of strong, durable Manila rope for gravity chute falls—they indicate the approximate amount of material to be "spouted" on this typical, eight-story, industrial plant job.

The best way to avoid costly breakage and replacement of rope on any construction work is to start with the best rope in the first place.

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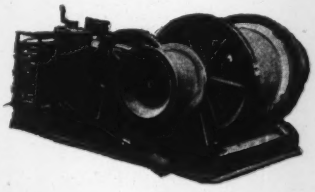

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Illustration shows one of the types furnished.

We are prepared to furnish any style, type or size of dock hoist provided it is **electric.**

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An Ideal Investment—

for excavating, pile driving and contracting work in general.

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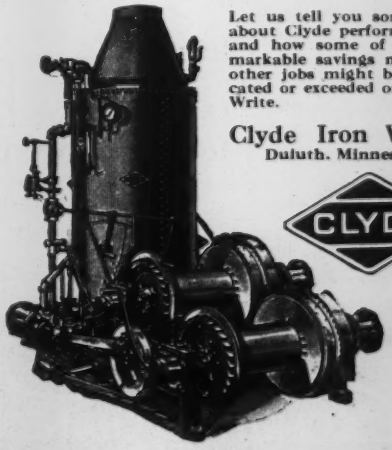

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For General Contracting Service

In designing this grab, simplicity in every detail without sacrificing sturdiness was the watchword. We particularly recommend it for general contracting use where sand, crushed stone or similar material is to be handled. It will dig just as well from the *side* of the sand pile, as from the top.

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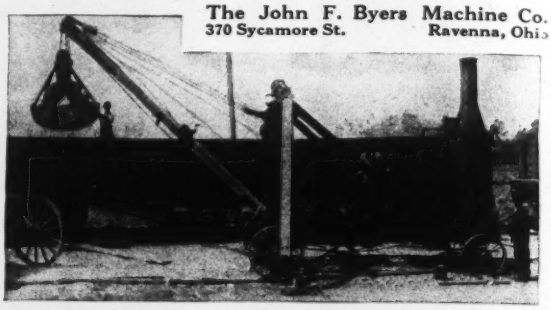

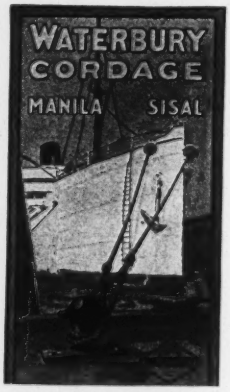

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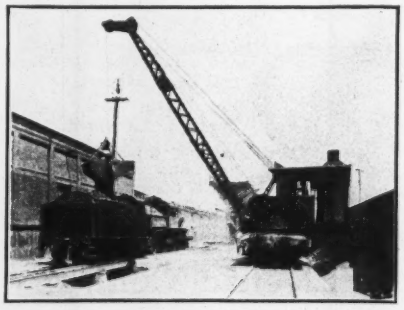

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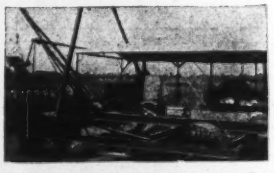

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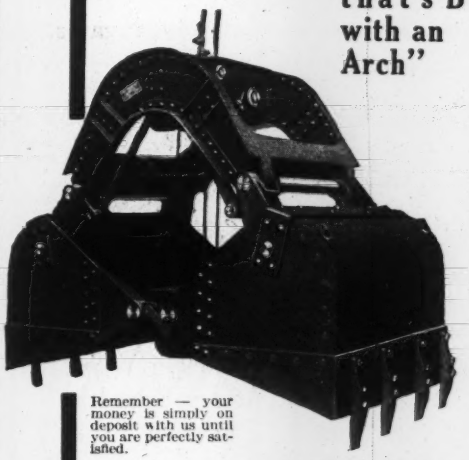

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One glance at the picture will show you the big new feature in bucket construction which makes this bucket different from all others.

The severest digging stresses cannot strain its heavy steel arch yoke. The hardest material gives way to the irresistible bite of its jaws.

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Bring Down Your Material Handling Cost

By Using

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They handle more material per hour at a less cost per yard for operation and repairs than ordinary buckets.

Being constructed entirely of steel with hard bronze bushed sheaves their endurance under extreme duty is positively unsurpassed.

Ask any leading contractor what he thinks of the Williams.

A corps of experienced bucket engineers will gladly cooperate with you in selecting the most economical size and type.

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Controllable Bottom Dump Bucket (Patented)

Big Handling Capacity

and extreme durability are the foremost features of the

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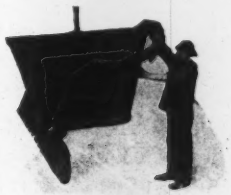
These steel buckets positively excel in efficiency. They effect a large money saving to the contractor on all work involving the handling of bulk material. *Write for Catalog "N."*



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Consult us on any bucket problem.

Self-Dumping and Self-Righting Turnover Bucket

The full Stuebner line consists of Coal Hoisting, Mining, Excavating and Bottom Discharge Buckets — Steel Skips — Side and End Tip, Rotary Dump, Drop Bottom and Boiler Room Cars—Asphalt, Tar and Lead Melters, Hand Dump Carts, etc., etc.

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For every kind of submarine work. Furnishers to U. S. Navy and Army Engineer Corps. *Large stock always on hand.*

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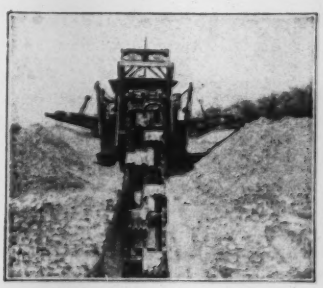

Insure low yardage cost on all kinds of trench excavation. Dig both wide and narrow sizes on same job and are easily adjustable; produce finished trench in single continuous operation; handle the stickiest soil without difficulty owing to self-cleaning buckets; equipped with multi-pedal traction.

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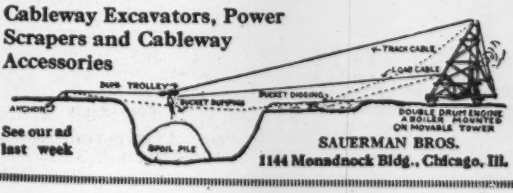

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Will lay more brick per barrel.
It has no waste.
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The Problem of Maximum Strength With Minimum Area is Solved by

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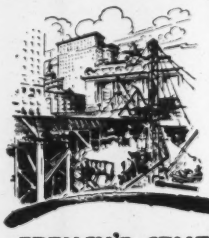

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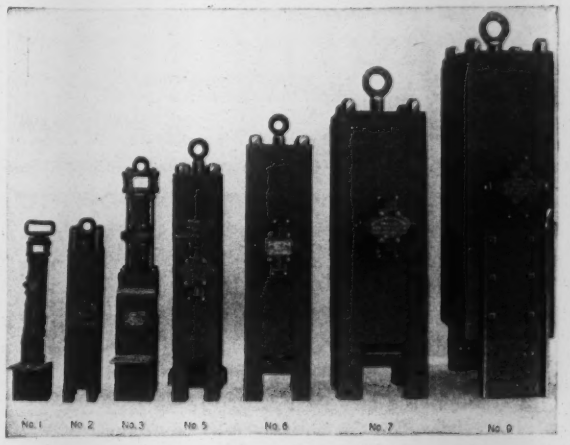

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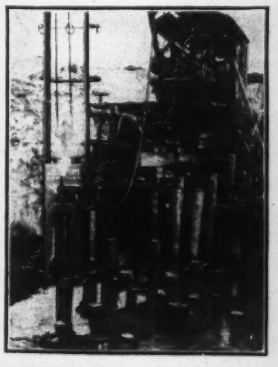

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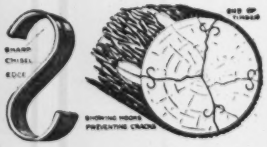

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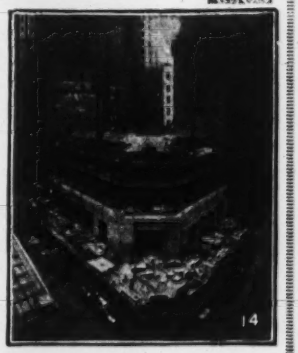

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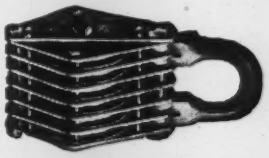

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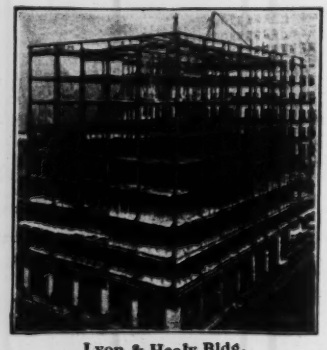

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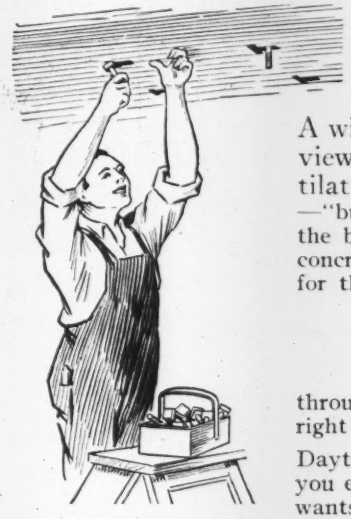

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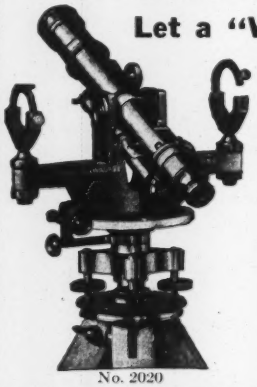

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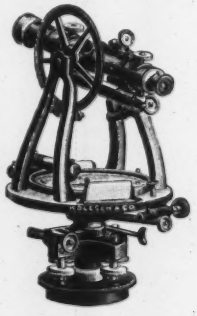

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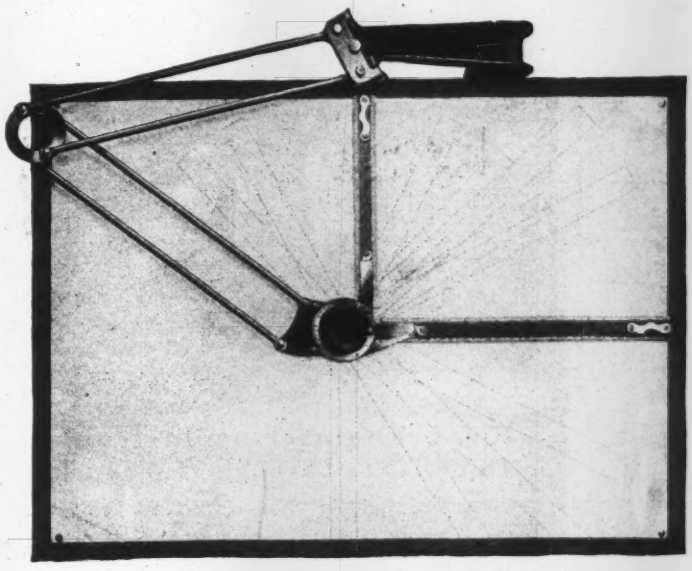

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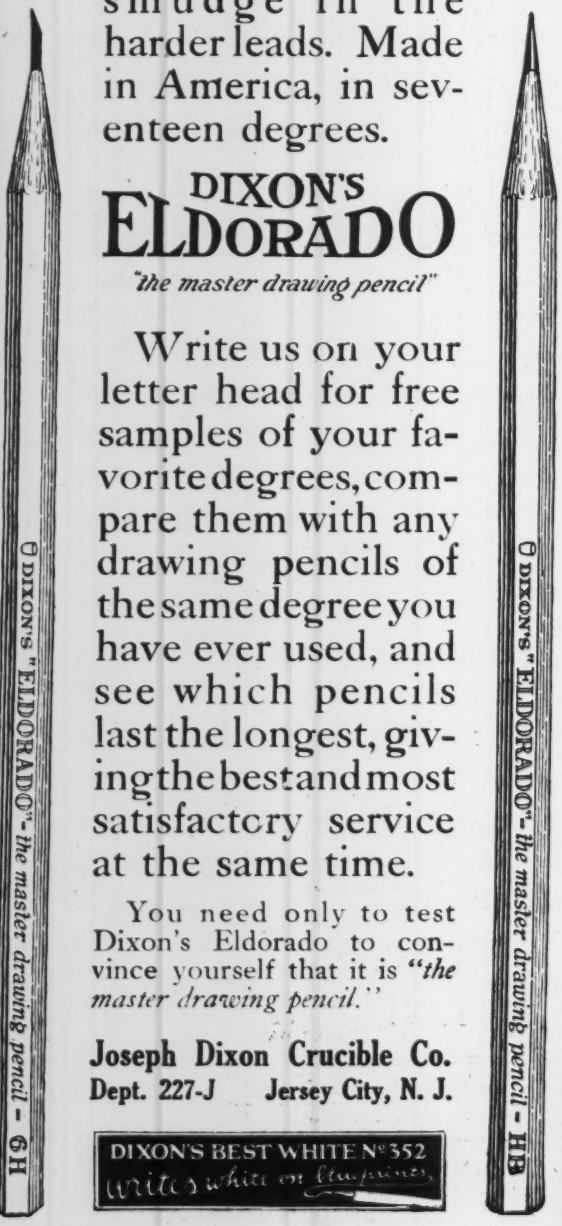

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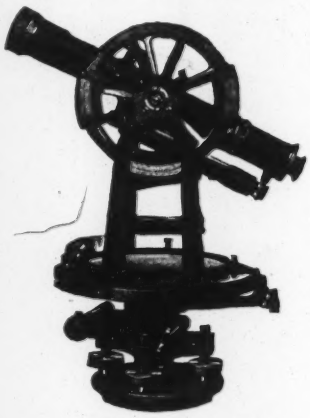

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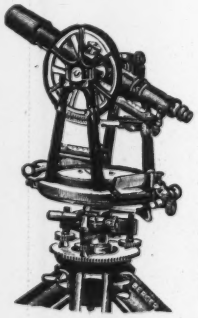

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Asbestos Protected Metal Co., Beaver Falls, Pa.
Carey Co., Philip, 18 Wayne Ave., Lockland, Ohio.

Ash Handling Machinery
Hunt Co., C. W., West New Brighton, N. Y.
Jeffrey Mfg. Co., The, 923 N. 4th St., Columbus, O.
Webster Mfg. Co., Tiffin, Ohio.

Asphalt
Carey Co., Philip, 18 Wayne Ave., Lockland, O.
Pioneer Asphalt Co., Lawrenceville, Ill.

Balances
Ainsworth & Sons, Wm., Denver, Colo.

Ballast Unloaders
Marion Steam Shovel Co., Station M, Marion, O.

Barges, Steel
American Bridge Co., 30 Church St., N. Y. City.
Chicago Bridge & Iron Works, Chicago, Ill.

Bearings and Bushings (Oilless)
Metaline Co., The, 6 West Ave., L. I. City, N. Y.
Made in all sizes for sheaves and like bearings.

Belting
Robins Conveying Belt Co., 14 Park Row, N. Y. C.

Bins, Storage
Brown Hoisting Machy. Co., Cleveland, Ohio.
Ransome Concrete Machinery Co., Dunellen, N. J.

Blasting Supplies
Aetna Explosives Co., Inc., 2 Rector St., N. Y. C.

Blocks
Boston & Lockport Block Co., East Boston, Mass.
Patterson Co., W. W., 50 Water St., Pittsburgh, Pa.
Pittsburgh Block & Mfg. Co., Pittsburgh, Penn.

Blow-Pipes and Burners
American Gas Furnace Co., 24 John St., N. Y. C.

Blowers, Pressure
American Gas Furnace Co., 24 John St., N. Y. C.

Blueprinting Machines
Keuffel & Esser Co., Hoboken, N. J.; N. Y. City.
Pease Co., C. F., 215 Institute Place, Chicago, Ill.
Williams, Brown & Earle, Philadelphia, Penn.

Blue Print Paper
Defiance Mfg. Co., 22 E. 41st St., New York City.

Boilers
Babcock & Wilcox Co., 85 Liberty St., N. Y. C.
Branch offices in principal cities.
"B & W," "Sterling" and "Rust" water-tube boilers.
Lidgerwood Mfg. Co., 96 Liberty St., New York.
Struthers-Wells Co., Warren, Penn.

Boilers, Water Tube
Abrendroth & Root Mfg. Co., 45 Bway., N. Y. C.

Books
McGraw-Hill Book Co., Inc., 239 W. 39th St., New York City.
Wiley & Sons, John, New York City.

Brakes, Air
Westinghouse Air Brake Co., E. Pittsburgh, Pa.

Bridges and Buildings
American Bridge Co., 30 Church St., N. Y. City.
Berlin Construction Co., Berlin, Conn.
Bethlehem Steel Bridge Co., South Bethlehem, Pa.
Blaw Steel Construction Co., Pittsburgh, Penn.
Case Crane & Eng'r'g Co., Columbus, Ohio.
Eastern Bridge & Structural Co., Worcester, Mass.
Fort Pitt Bridge Works, Pitsburgh, Penn.
Kenwood Bridge Co., Chicago, Ill.
King Bridge Co., Cleveland, Ohio.
Lackawanna Bridge Co., New York.
Levering-Garrigues Co., 552 W. 23rd St., N. Y. C.
McClintic-Marshall Co., Pittsburgh, Penn.
Milwaukee Bridge Co., Milwaukee, Wis.
Minneapolis Steel & Mchry. Co., Minneapolis.
Missouri Valley Bridge & Iron Co., Leavenworth, Kan.
Mount Vernon Bridge Co., Mt. Vernon, Ohio.
Penn Bridge Co., Beaver Falls, Penn.
Phoenix Bridge Co., Phoenixville, Penn.
Riter-Conley Mfg. Co., Pittsburgh, Penn.
Riverside Bridge Co., Martins Ferry, Ohio.
Scherzer Rolling Lift Bridge Co., The, Chicago, Ill.
Shoemaker & Co., Lewis F., Pottstown, Penn.
Snare & Triest Co., The, Woolworth Bldg., N. Y. C.
Strobel Steel Construction Co., Chicago, Ill.

Bridges, Bascule
American Bridge Co., 30 Church St., N. Y. City
Chicago Bridge & Iron Works, Chicago, Ill.
Scherzer Rolling Lift Bridge Co., The, Chicago, Ill
Strauss Bascule Bridge Co., Chicago, Ill.
Strobel Steel Construction Co., Chicago, Ill.

Bridge Floors
Jennison-Wright Co., 2462 Broadway, Toledo, Ohio.
Kreolite wood block bridge floors and bridge timbers framed and creosoted

Buckets, Concrete
Automatic Concrete Mixer Co., Providence, R. I
Hayward Co., The, 50 Church St., N. Y. City.
Insley Mfg. Co., Indianapolis, Ind.
Stuebner Iron Works, G. L., W. 11th St., Long Island City, N. Y.
McMyler Interstate Co., Bedford, Ohio.
Union Iron Works, West Shore Station, Hoboken N. J.

Buckets, Dragline Scraper
Brown Hoisting Machy. Co., Cleveland, Ohio.
Hayward Co., The, 50 Church St., N. Y. City.

Buckets, Dredging
American Bridge Co., 30 Church St., N. Y. City.
Blaw Steel Construction Co., The, Pittsburgh, Pa.
Buffalo Contractors Plant Corp., Buffalo, N. Y.
Concrete Steel Co., New York City.
Hayward Co., The, 50 Church St., N. Y. City.
McMyler Interstate Co., Bedford, Ohio.
Mead-Morrison Mfg. Co., East Boston, Mass.
Steubner Iron Works, G. L., W. 11th St., Long Island City.
Williams Co., G. H., Cleveland, Ohio.

Card lists of Equipment are hard to keep. they won't correct themselves. this list will

Buckets, Orange Peel and Clam Shell
Blaw Steel Construction Co., The, Pittsburgh, Pa.
Brown Hoisting Machy. Co., Cleveland, Ohio.
Buffalo Contractors Plant Corp., Buffalo, N. Y.
Geo. Haiss Mfg. Co., 142d St. & Ryder Ave., N. Y. C.
Hayward Co., 50 Church St., New York City.
Standard and special sizes. Capacities 100 cubic inches up. Equipped with power wheel rope guards. All parts interchangeable.
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Industrial Works, Bay City, Mich.
Designed for quick attachment or removal.
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McMyler Interstate Co., Bedford, Ohio.
Mead-Morrison Mfg. Co., East Boston, Mass.
Union Iron Works, West Shore Station, Hoboken, N. J.
Whiting Foundry Equipment Co., Harvey, Ill.
Williams Co., G. H., Cleveland, Ohio.

Building Paper
Barrett Company, The, New York City.
Berlin Mills Co., Portland, Maine.
Carey Co., Philip, 18 Wayne Ave., Lockland, Ohio.

Building Specialties
Asbestos Protected Metal Co., Beaver Falls, Pa.
Barrett Company, The, New York City.
Mississippi Wire Glass Co., 218 Fifth Ave., New York City.
Wire glass for fireproof constructions. Clear, frosted, patterned and special light transmitting. Sample, report on light diffusion and general catalog on request.

Cableways
American Steel & Wire Co., Chicago, Ill.
Flory Mfg. Co., S., Bangor, Penn.
Horton, John T., 92 West St., New York City.
Lidgerwood Mfg. Co., 96 Liberty St., New York
Waterbury Co., The, 63 Park Row, N. Y. City.

Caissons
American Bridge Co., 30 Church St., N. Y. City
Chicago Bridge & Iron Works, Chicago, Ill.
Foundation Co., The, Woolworth Bldg., New York.
Struthers-Wells Co., Warren, Penn.

Cars, Contractors'
Continental Car Co., Inc., Pierce Bldg., St. Louis, Mo.
Easton Car & Construction Co., Easton, Penn
Insley Mfg. Co., Indianapolis, Ind
Ornstein-Arthur Koppel Co., Pittsburgh, Pa.
Union Iron Works, West Shore Station, Hoboken, N. J.
Western Wheeled Scraper Co., Aurora, Ill.

Cars, Dump
Continental Car Co., Inc., Pierce Bldg., St. Louis, Mo.
Easton Car & Construction Co., Easton, Penn
Insley Mfg. Co., Indianapolis, Ind.

Cars, Freight and Passenger
Pressed Steel Car Co., New York, Pittsburgh, Chicago, St. Paul, Minn.

Cars, Industrial
Continental Car Co., Inc., Pierce Bldg., St. Louis, Mo.
Easton Car & Construction Co., Easton, Penn
Hunt Co., Inc., C. W., West New Brighton, N. Y.
Ramapo Iron Works, Hillburn, N. Y.
Stuebner Iron Works, G. L., W. 11th St., Long Island City, N. Y.

Cars, Steel
Pressed Steel Car Co., New York, Pittsburgh, Chicago, St. Paul, Minn.

Carts, Concrete
Insley Mfg. Co., Indianapolis, Ind.
Ransome Concrete Mchy. Co., Dunellen, N. J. Cable: Racomaw. Branches: Chicago, Philadelphia, Boston, New York, Columbus, Ohio.
Stuebner Iron Works, G. L.,W. 11th St., Long Island City, N. Y.

Castings, Iron and Steel
Cast Iron Pipe Publicity Bureau, No. 1 Broadway, New York City.
Central Foundry Co., New York City.
Fox & Co., John, 253 Broadway, New York City.
McConway & Torley Co., Pittsburgh, Penn.
Sessions Foundry Co., Bristol, Conn.
U. S. Cast Iron Pipe Co., Philadelphia, Penn.
Warren Fdry. & Mach. Co., 11 B'dway, N. Y. C.

Castings, Malleable Iron
Jeffrey Mfg. Co., The, 923 N. 4th St. Columbus, O.

Castings (Street and Sewer)
Central Foundry Co., New York City.
Sessions Foundry Co., Bristol, Conn.
U. S. Cast Iron Pipe Co., Philadelphia, Penn.

Cement, Iron
Smooth-On Mfg. Co., Jersey City, N. J.

Cement Making Machinery
Smidth & Co., F. L., New York City.
Vulcan Iron Wks., 1735 Main St., Wilkes-Barre.
Worthington Pump & Mchy. Corp., 115 Bway., N. Y.

Cement, Natural
Consolidated Rosendale Cement Co., The, 50 Church St., New York City.

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Three sizes. Capacities variable according to number of nozzles, hose, sizes and air pressures. The "Cement-Gun" is a portable apparatus for depositing cement or "Gunite" coatings by air pressure for covering old or new structures, building new ones and grouting or filling cracks.

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French & Co., Samuel H., Philadelphia, Penn.
"French's" brand.
Lawrence Cement Co., 1 Broadway, N. Y. City.
Nazareth Cement Co., Nazareth, Penn.

Cement, Portland White
Lawrence Cement Co., 1 Broadway, N. Y. City.

Centers, Steel Collapsible
Blaw Steel Construction Co., Pitttsburgh, Penn

Chain
Pittsburgh Block & Mfg. Co., Pittsburgh, Penn.

Chains, Transmission
Jeffrey Mfg. Co., The, 923 N. 4th St., Columbus, O.
Webster Mfg. Co., The, Tiffin, Ohio.

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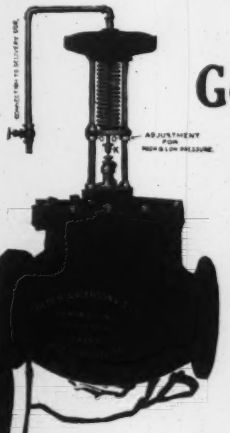
for many a vexatious problem in fire, sprinkler and other water distribution systems and a positive cure for all needless water waste down the overflow of Tanks, Standpipes and Reservoirs.



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For automatically maintaining Uniform Stage of Water in Tank, Reservoir or Standpipes. Doing away with the annoyances of Freezing and Float Fixtures inside or outside of Tanks. "Three Ways of Closing These Valves."

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Valves Cushioned at all times by air and water
No water hammer or bursting mains

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No waste of current as it is only on solenoid a few seconds on either opening or closing of valve.

May be closed and opened from remote points electrically; also hand operated.

Air and water cushioned. No metal-to-metal seats. Virtually indestructible.

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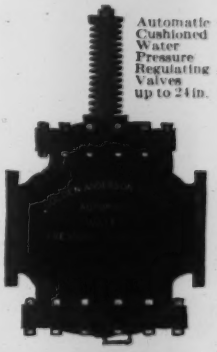
for high or low pressure service are a *necessity* for modern water works and railroads.

Positive in action and perfectly **cushioned both** in opening and closing.

Will maintain a constant pressure regardless of the volume of the initial flow.

When fitted with electric attachment, valve can be instantly opened to full area from any number of distant points, thus insuring full pressure in case of fire, etc.



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How about *your* boiler room and *your* workmen? Here are valves which are life and property insurance. They are as important as pop-safety valves. They always work, yet smoothly, without chattering themselves into junk. They are *double cushioned*. You need them in your plant. Prevent shutdowns.

WE MAKE THE LARGEST LINE OF AUTOMATIC STEAM AND WATER SERVICE VALVES IN THE U. S.

Golden-Anderson Valve Specialty Co.

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Weber Chimney Co., 1453 McCormick Bldg., Chicago, Ill. Aguilar, 104, Havana, Cuba.

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Custodis Chimney Constr. Co., Alphons, Bennett Bldg., New York City.
Heine Chimney Co., Chicago, Ill.
Hillesheim Chimney Construction Co., 432 Belden Ave., Chicago, Ill.
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Marion Malleable Iron Co., Marion, Ind.

Coal and Ore Handling Machinery
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Blaw Steel Construction Co., The, Pittsburgh, Pa.
Brown Hoisting Machinery Co., Cleveland, Ohio.
Hayward Co., The, 50 Church St., New York City.
Geo. Haiss Mfg. Co., 142d St. & Ryder Ave. N. Y. C.
Hunt Co., Inc., C. W., West New Brighton, N. Y.
Jeffrey Mfg. Co., The, 923 N. 4th St., Columbus, O.
Lidgerwood Mfg. Co., 96 Liberty St., N. Y. City.
Link-Belt Co., Chicago, Ill.
Maine Electric Co., Portland, Maine.
McMyler Interstate Co., Bedford, Ohio.
Mead-Morrison Mfg. Co., East Boston, Mass.
Orton & Steinbrenner Co., Chicago, Ill.
Webster Mfg. Co., The, Tiffin, Ohio.
Whiting Foundry Equipment Co., Harvey, Ill.
Worthington Pump & Mchy. Corp., 115 Bway., N. Y.

Coal Storage Systems
American Bridge Co., 30 Church St., N. Y. City.
Brown Hoisting Machy. Co., Cleveland, Ohio.
Jeffrey Mfg. Co., The, 923 N. 4th St., Columbus, O.
Mead-Morrison Mfg. Co., East Boston, Mass.

Column Guards, Steel
Blaw Steel Construction Co., Pittsburgh, Penn.

Compounds, Waterproofing
Barrett Company, The, New York City.
Protective Material Corp., 51 E. 42nd St., N. Y. C.
Smooth-On Mfg. Co., Jersey City, N. J.

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Chicago Pneumatic Tool Co., Chicago, Ill.
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Stationary and portable, power driven and steam driven.
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Sampson Co., Geo. H., 13 Pearl St., Boston, Mass. 32 Broadway, New York City.
Westinghouse Air Brake Co., E. Pittsburgh, Pa.
Worthington Pump & Mchy. Corp., 115 Bway., N. Y.

Compressors, Gas and Ammonia
Norwalk Iron Works, South Norwalk, Conn.
Worthington Pump & Mchy. Corp., 115 Bway., N. Y.

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Foundation Co., The, Woolworth Bldg., New York.
Raymond Concrete Pile Co., 140 Cedar St., New York, N. Y. Branches: Chicago, Pittsburgh, Boston, Baltimore, Philadelphia, Atlanta, Detroit, Cleveland, St. Louis, Portland, Oregon; San Francisco, Los Angeles, Omaha, Cincinnati, St. Paul, Kansas City and Montreal.
Cast-in-place and pre-cast concrete piles, concrete interlocking sheet piles, docks, wharves, bulkheads, roads, bins, monolithic foundations, retaining walls, jetties, etc.
See ad. always on page 3.
Smith, Hauser & MacIsaac, Inc., 18 East 41st St., New York City.
Trussed Concrete Steel Co., Dept. 12, Youngstown, Ohio.
"Kahn" reinforcement and specialties for concrete.
Representatives in principal cities.
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Reinforced-concrete chimneys and towers.

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Anti-Hydro Waterproofing Co., 170 Washington St., Newark, N. J.
Protective Material Corp., 51 E. 42nd St., N. Y. C.
Trus-Con Laboratories Co., Detroit, Mich.

Concrete Floor Hardener
Protective Material Corp., 51 E. 42nd St., N. Y. C.

Concrete Reinforcement
American Steel & Wire Co., Chicago, Ill.
Brown Hoisting Machy. Co., Cleveland, Ohio.
Buffalo Steel Co., Tonawanda, N. Y.
Concrete Steel Co., 42 Broadway, New York City.
Consolidated Expanded Metal Co., N. Y. City.
General Fireproofing Co., Youngstown, Ohio.
Lackawanna Steel Co., Lackawanna, N. Y. Branches: New York, Boston, Buffalo, Philadelphia, Cleveland, Cincinnati, Chicago, Detroit, St. Louis, Atlanta, San Francisco.
Laclede Steel Co., St. Louis, Mo. Chicago Office: 332 S. Michigan Ave. Works: Madison, Ill.
Northwestern Expanded Metal Co., Chicago, Ill.
Trussed Concrete Steel Co., Dept. 12, Youngstown, Ohio.
"Kahn Sys." Reinf., "Kahn" bars, "Rib" bars, "Rib" metal lath, "Kahn" mesh, "Hy Rib" Floretyles, Floredoms, column hooping.
Representatives in principal cities.
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Design "Sackett Domes" for reinforced concrete floor design, to carry the net load only until the concrete is set. The "Sackett Dome" is especially dseirable for spanning distances of 13 ft. or more under a light load. They are made of a waterproofed, reinforced "Sackett" plaster board, mounted to proper shape with a flat "Sackett" sheet attacher at bottom to form a flat plastering surface for ceiling.
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Worthington Pump & Mchy. Corp., 115 Bway., N. Y.

Conduits
National Tank & Pipe Co., Portland, Ore.

Contractors, General
Levering-Garrigues Co., 552 W. 23rd St., N. Y. C.
Smith, Hauser & MacIsaac, Inc., 18 East 41st St., New York City.

Contractors' Equipment
Sampson Co., Geo. H., 13 Pearl St., Boston, Mass. 32 Broadway, New York City.

Controllers, Electric
General Electric Co., Schenectady, N. Y.

Conveyors
Gifford-Wood Co., Hudson, N. Y.
Hunt Co., Inc., C. W., West New Brighton, N. Y.
Jeffrey Mfg. Co., 923 N. 4th St., Columbus, Ohio.
Ohio Locomotive Crane Co., Bucyrus, Ohio.
Robins Conveying Belt Co., 14 Park Row, N. Y. C.
Webster Mfg. Co., The, Tiffin, Ohio.
Worthington Pump & Mchy. Corp., 115 Bway., N. Y.

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McConway & Torley Co., Pittsburgh, Penn.

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Covering, Underground Steam Pipe
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3 to 40 tons capacity—steam or electric—various gauges—different lengths of boom.
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Five to 160 tons cap. Steam, electric, gasoline.
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Orton & Steinbrenner Co., Chicago, Ill.
Five- to 150-ton. All types and equipment.

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Case Crane & Engineering Co., Columbus, Ohio.
Northern Engineering Works, Detroit, Mich.
Terry & Tench Co., Inc., 70 E. 45th St., N. Y. C.
Whiting Foundry Equipment Co., Harvey, Ill.

Cranes, Wrecking
Industrial Works, Bay City, Mich.
Ohio Locomotive Crane Co., Bucyrus, Ohio.

Creosoted Conduits
Michigan Pipe Co., Bay City, Mich.

Creosoting
American Creosoting Co., 17 Battery Pl., N. Y. C.
American Creosote Wks., New Orleans, La. (Sta. B).
Barrett Co., The, New York City.
Eppinger & Russell Co., 165 Broadway, New York.
International Creosoting & Construction Co., Galveston, Tex.
Jennison-Wright Co., 2462 Broadway, Toledo, Ohio.
Norfolk Creosoting Co., Norfolk, Va.
Wyckoff Pipe & Creosoting Co., 30 E. 42nd St., New York City.

Crushers and Pulverizers
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Austin-Western Road Machinery Co., Chicago, Ill.
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Jeffrey Mfg. Co., The, 923 N. 4th St., Columbus, O.
Orton & Steinbrenner Co., Chicago, Ill.
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Baker, Wm. M., Baltimore, Md.
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California Cor. Culvert Co., West Berkeley, Calif.
Coast Culvert & Flume Co., Portland, Ore.
Corrugated Culvert Co., Moberly, Mo.
Dixie Culvert & Metal Co., Atlanta, Ga.
Hardesty Mfg. Co., R., Denver, Colo.
Illinois Corrugated Metal Co., Bloomington, Ill.
Independence Culvert Co., Independence, Iowa.
Iowa Pure Iron Culvert Co., Des Moines, Iowa.
Kentucky Culvert Co., Louisville, Ky.
Lee-Arnett Co., Lincoln, Neb.
Lone Star Culvert Co., Houston, Tex.
Lyle Corrugated Culvert Co., Minneapolis, Minn.
Michigan Bridge & Pipe Co., Lansing, Mich.
Montana Culvert & Flume Co., Missoula, Mont.
Nebraska Culvert & Mfg. Co., Wahoo, Neb.
New England Metal Cul. Co., Palmer, Mass.
North-East Metal Culvert Co., Nashua, N. H.
Northwestern Sheet & Iron Wks., Wahpeton, N. D.
Ohio Corrugated Culvert Co., The, Middletown, O.
O'Neall Co., W. O., Crawfordsville, Ind.
Pennsylvania Metal Cul. Co., Flemington, N. J.
Pennsylvania Metal Cul. Co., Warren, Penn.
Road Supply & Metal Co., The, Topeka, Kan.
Sioux Falls Metal Culvert Co., Sioux Falls, S. D.
Spokane Cor. Cul. & Tank Co., Spokane, Wash.
Tennessee Metal Culvert Co., Nashville, Tenn.
Utah Cor. Cul. & Flume Co., Woods Cross, Utah.
Virginia Metal Culvert Co., Roanoke, Va.
Western Metal Mfg. Co., El Paso, Tex.
Wyatt Metal Works, Dallas, Tex.

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Armco Iron Culvert & Flume Manufacturers Association, Middletown, Ohio.
Baker, Wm. M., Baltimore, Md.
Bark River Bridge & Culvert Co., Bark River, Mich.
Corrugated Culvert Co., Moberly, Mo.
Dixie Culvert & Metal Co., Greensboro, N. C.
Lee-Arnett Co., Lincoln, Neb.
Lyle Corrugated Culvert Co., Lyle, Minn.
Lyle Corrugated Culvert Co., Minneapolis, Minn.
Michigan Bridge & Pipe Co., Lansing, Mich.
Montana Culvert Co., Missoula, Mont.
Nebraska Culvert & Mfg. Co., Wahoo, Neb.
Nevada Metal Mfg. Co., Reno, Nev.
North-East Metal Culvert Co., Nashua, N. H.
Northwestern Sheet & Iron Wks., Wahpeton, N. D.
Pennsylvania Metal Culvert Co., Auburn, N. Y.
Pennsylvania Metal Culvert Co., Flemington, N. J.
Warren Fdry. & Mach. Co., 11 B'dway, N. Y. C.
Wood & Co., R. D., Philadelphia, Penn.

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Blaw Steel Construction Co., Pittsburgh, Penn.

Curb Steel Protected Concrete
Trussed Concrete Steel Co., Dept. 12, Youngstown, Ohio.
"Kahn" curb bars.
Representatives in principal cities.

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Hayward Co., The, 50 Church St., New York City.
Horton, John T., 92 West St., New York City.
Lidgerwood Mfg. Co., 96 Liberty St., N. Y. City.
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McMyler Interstate Co., Bedford, Ohio.
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Pipe, Sewer
Robinson Clay Products Co., Akron, Ohio.

Pipe Specials
Builders Iron Foundry, Providence, R. I.
Wood & Co., R. D., Philadelphia, Penn.

Pipe, Spiral Riveter
Abrendroth & Root Mfg. Co., 45 Bway., N. Y. C.

Pipe, Steel
National Tube Co., Pittsburgh, Penn.

Pipe, Wood
National Tank & Pipe Co., Portland, Ore.
We manufacture machine banded pipe in sizes 2" to 32". Continuous stave pipe up to 14'.
Pacific Coast Pipe Co., Seattle, Wash.
Two inches to 14 ft. diameter, up to 300' head.
Portland Wood Pipe Co., Portland, Ore.
Redwood Manufacturers Co., 1605 Hobart Bldg., San Francisco, Calif.
Washington Pipe & Foundry Co., 1512-1620 Center St. and 3001-3019 Asotin St., Tacoma, Wash.
Cable: Wash Pipe.
Sizes from 2 inches up. Machine banded, continuous stave and special pipe.
Wyckoff & Son Co., A., Elmira, N. Y.

Poles, Cross Arms, Etc., Creosoted
Jennison-Wright Co., 2462 Broadway, Toledo, Ohio.

Poles, Cross-Arms, Etc. (Treated Wood)
Berlin Mills Co., Portland, Maine.
National Tank & Pipe Co., Portland, Oregon.

Poles, Tubular Steel
American Bridge Co., 30 Church St., N. Y. City.
National Tube Co., Pittsburgh, Penn.

Powder
Aetna Explosives Co., Inc., 2 Rector St., N. Y. C.

Power Transmission Machinery
Jeffrey Mfg. Co., The, 923 N. 4th St., Columbus, O.
Leffel & Co., James, Springfield, Ohio.
Webster Mfg. Co., The, Tiffin, Ohio.

Dodge Manufacturing Company

has acquired the properties and will control the manufacture of the entire products of *Oneida Steel Pulley Company, and Keystone Steel Pulley Company;*

the succeeding operating organization will be known as

Dodge Steel Pulley Corporation of Oneida, N.Y.

In the future the sales and distribution of

DODGE *ONEIDA* AND KEYSTONE

WOOD AND IRON, SOLID AND SPLIT PULLEYS — **STEEL SPLIT PULLEYS**

will be under the exclusive supervision and control of

Dodge Sales and Engineering Company of Mishawaka, Ind.

through its many branch warehouses, district organizations and their accredited Sales Agencies throughout the world.

INDEPENDENCE
Wood Split Type

STANDARD
Iron Split Type

Thirty-five years ago, Wallace H. Dodge conceived the idea of a split pulley made of hardwood, embodying the fundamental principles of compression shaft fastening, and of an interchangeable bushing system.

In this original Dodge idea was the basis for a new commercial and economic development, which is now recognized as one of the most important branches of industrial engineering.

The Dodge Bushing System of 1882 remains unchanged in 1917; through its interchangeability, a range of 108,000 pulleys with fixed bores, faces and diameters may be covered by an extreme total of 2,700 pulleys of standardized bores and 40 bushings; this is the Dodge idea from the commercial viewpoint.

From the economic viewpoint, the factory owner now buys one pulley which may be fitted to 40 shafts instead of one, at the slight cost of a new bushing; in consequence, a pulley purchase of today is regarded as a permanent asset.

Thus, as early as 1882, Wallace H. Dodge, founder of Dodge Manufacturing Company, was acknowledged the inventor and patentee of those principles which today govern the manufacture of all stock pulleys.

In 1900, the Standard Cast Iron Split Pulley, using similar metallic interchangeable bushings, was added to the Dodge line by purchase, for even then the split bushed pulley was being copied in other materials than the original wood type. The Standard Cast Iron Split Pulley became a part of the Dodge line full-born; a product that had profited by and attained perfection through the pioneer invention of Mr. Dodge and the experience of others.

And now, in 1917, we announce the further addition of the steel type of split pulley as the final justification of the Dodge slogan, "A Perfect Pulley for Every Place."

Our final satisfaction in this announcement is two-fold; *first*, in being the only pulley manufacturer in the entire world who may offer, without prejudice, the proper type of pulley for the work in hand; and *second*, in the knowledge that we are furnishing, in every case, the highest development of pulley construction, whether of wood, iron or steel.

All are products worthy of the name "DODGE;" by the performance of each we are ready to stand or fall, according to our recommendation for their use.

Thus our ability to render true service, unprejudiced service, to industrial plants; to their superintendents, master mechanics and workmen; to dealers in power transmission equipment; to power users the world over, is such as to justify you in specifying Dodge Products for all power transmission requirements.

ONEIDA
Steel Split Type

KEYSTONE
Steel Split Type

Pulverizers
Raymond Bros. Impact Pulverizer Co., 1313 N. Branch St., Chicago, Ill., U. S. A. "Impact" complete line of pulverizing and air separating machinery for large and small capacities.
Jeffrey Mfg. Co., The, 923 N. 4th St., Columbus, O.

Pumps, Air
Cameron Steam Pump Works, A. S., 11 Broadway, New York City.
Worthington Pump & Mchy. Corp., 115 Bway., N. Y.

Pumps, Air Lift
Ingersoll-Rand Co., 11 Broadway, New York City.
Sullivan Mach. Co., 122 S. Mich. Ave., Chicago.
Worthington Pump & Mchy. Corp., 115 Bway., N. Y.

Pumps, Centrifugal
Alberger Pump & Condenser Co., New York City.
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
American Well Works, The, Aurora, Ill.
Cameron Steam Pump Works, A. S., 11 Broadway, New York City.
Darling Pump & Mfg. Co., Williamsport, Penn.
De Laval Steam Turbine Co., Trenton, N. J.
Single- and multi-stage horizontal and vertical.
Lawrence Machine Co., Lawrence, Mass.
Morris Machine Works, Baldwinsville, N. Y.
Pelton Water Wheel Co., San Francisco, Calif.
Rumsey Pump Co., Seneca Falls, New York.
Worthington Pump & Mchy. Corp., 115 Bway., N. Y.

Pumps, Contractors'
Bond Co., Harold L., Boston, Mass.
Cameron Steam Pump Works, A. S., 11 Broadway, New York City.
Nye Steam Pump & Machinery Co., 705 N. Western Ave., Chicago, Ill.
Parker, A. A., Waterford, N. Y.
Pulsometer Steam Pump Co., Irvington, N. J.
Van Nouhuys Machine Wks., Albany, New York.
Worthington Pump & Mchy. Corp., 115 Bway., N. Y.

Pumps, Deep Well
American Well Works, The, Aurora, Ill.
Cameron Steam Pump Works, A. S., 11 Broadway, New York City.
Cook, A. D., Lawrenceburg, Ind.
For 2 to 12" wells. Cap. 500 gal. per m.
Keystone Driller Co., Beaver Falls, Penn.
Pelton Water Wheel Co., San Francisco, Calif.
Rumsey Pump Co., Seneca Falls, New York.
Worthington Pump & Mchy. Corp., 115 Bway., N. Y.

Pumps, Diaphragm
Bond Co., Harold L., Boston, Mass.
Boston & Lockport Block Co., East Boston, Mass.
Edson Mfg. Co., 278 Atlantic Ave., Boston, Mass.
3 sizes, 2½, 3 and 4" suc. 1800-6000 gal. per hr.
Parker, A. A., Waterford, N. Y.
Rumsey Pump Co., Seneca Falls, New York.
Van Nouhuys Machine Wks., Albany, New York.

Pumps, Dredging
Lawrence Machine Co., Lawrence, Mass.
Morris Machine Works, Baldwinsville, N. Y.
Parker, A. A., Waterford, N. Y.
Worthington Pump & Mchy. Corp., 115 Bway., N. Y.

Pumps, Gasoline Portable
Parker, A. A., Waterford, N. Y.
Worthington Pump & Mchy. Corp., 115 Bway., N. Y.

Pumps, Hand
Rumsey Pump Co., Seneca Falls, New York.

Pumps, Power
Cameron Steam Pump Wks., A. S., 11 Bway., N. Y.
Cook, A. D., Lawrenceburg, Ind.
McGowan Co., John H., Cincinnati, Ohio.
Rumsey Pump Co., Seneca Falls, New York.
Worthington Pump & Mchy. Corp., 115 Bway., N. Y.

Pumps, Rotary
Rumsey Pump Co., Seneca Falls, New York.

Pumps, Steam
Cameron Steam Pump Works, A. S., 11 Broadway, New York City.
Keystone Driller Co., Beaver Falls, Penn.
McGowan Co., John H., Cincinnati, Ohio.
Morris Machine Works, Baldwinsville, N. Y.
Worthington Pump & Machinery Corporation, 115 Broadway, New York City.

Pumps, Triplex
Rumsey Pump Co., Seneca Falls, New York.

Pumps, Turbine
Alberger Pump & Condenser Co., New York City.
American Well Works, The, Aurora, Ill.
Cameron Steam Pump Works, A. S., 11 Broadway, New York City.
General Electric Co., Schenectady, N. Y.
Lawrence Machine Co., Lawrence, Mass.
Morris Machine Works, Baldwinsville, N. Y.

Purifiers, Feed Water
New York Cont'l Jewell Filtration Co., N. Y. City.
Norwood Engr. Co., Florence, Mass.

Pyrometers
Taylor Instrument Co., Rochester, N. Y.

Rails
Bethlehem Steel Co., South Bethlehem, Penn.

Rails and Fastenings
Carnegie Steel Co., Pittsburgh, Penn.
Lackawanna Steel Co., Lackawanna, N. Y.
Branches: New York, Boston, Buffalo, Philadelphia, Cleveland, Cincinnati, Chicago, Detroit, St. Louis, Atlanta, San Francisco.
Standard heavy and light sections, contact rails, angle and splice bars, joint plates, tin plates, track spikes and bolts.

Rail Joints
Rail Joint Co., 185 Madison Ave., New York City.
Base supported rail joints. Types: "Continuous Tee," "Weber Tee," "Wolhaupter Tee," "Continuous Step," "Continuous Insulating," "Weber Insulating," "Continuous Girder," "Weber Girder," "Continuous Frog and Switch," "100% Tee Rail Straight Angle Bar" or "Bent Angle Bar." Hot-worked high carbon steel used, oil quenched when desired.

Reinforcing Materials
Asbestos Protected Metal Co., Beaver Falls, Pa.
Consolidated Expanded Metal Cos., The, Braddock, Penn.

Rivets
Bethlehem Steel Bridge Co., South Bethlehem, Pa.

Road Oils and Preservatives
Barrett Company, The, New York City.

Road Rollers
Austin Mfg. Co., Chicago, Ill.
Austin-Western Road Machy. Co., Chicago, Ill.

Road Screeds
Blaw Steel Construction Co., Pittsburgh, Penn.

Road Templets
Blaw Steel Construction Co., Pittsburgh, Penn.

Rolls, Crushing
Buchanan Co., C. G., 90 West St., N. Y. City.

Roofing
Barrett Company, The, New York City.
Carey Co., Philip, 18 Wayne Ave., Lockland, Ohio.
U. S. Gypsum Co., Chicago, Ill.

Roofing, Metal
American Sheet & Tin Plate Co., Pittsburgh, Pa.
Asbestos Protected Metal Co., Beaver Falls, Pa.
Youngstown Iron & Steel Co., Youngstown, Ohio.

Rope
Leschen & Sons Rope Co., A., St. Louis, Mo.
Plymouth Cordage Co., South Plymouth, Mass.

Rope, Manila
Waterbury Co., The, 63 Park Row, N. Y. City.

Only reliable goods can be advertised continuously—Only reliable and responsible concerns are listed here.

Rope, Transmission
Waterbury Co., The, 63 Park Row, N. Y. City.
Webster Mfg. Co., The, Tiffin, Ohio.

Rope, Wire
American Steel & Wire Co., Chicago, Ill.
Leschen & Sons Rope Co., A., St. Louis, Mo.
Waterbury Co., The, 63 Park Row, New York City.

Sash, Steel **(See Window Sash, Steel)**

Screens, Rotary
Jeffrey Mfg. Co., The, 923 N. 4th St., Columbus, O.
Webster Mfg. Co., The, Tiffin, Ohio.

Screens, Well
American Well Works, The, Aurora, Ill.

Searchlights
General Electric Co., Schenectady, N. Y.

Second-Hand Equipment
(See Alphabetical Index for For Sale Ads.)
Astoria Light, Heat & Power Co., The, East 132d St. and Locust Ave., New York City.
Bailey, R. W., 122 S. Michigan Blvd., Chicago, Ill.
Braden, James S., 26 Cortlandt St., N. Y. City.
Briggs, Inc., Marvin, 167 Sixth St., Bklyn., N. Y.
Buff, W. J., 50 Church St. New York City.
Contractors Machinery & Supply Co., Wabash Bldg., Pittsburgh, Penn.
Dallett & Co., Harrison Bldg., Philadelphia, Pa.
Eagle Pipe Supply Co., 30 Church St., N. Y. City.
Engineering Agency, Inc., Monadnock Block, Chicago, Ill.
Frank, M. K., Frick Bldg., Pittsburgh, Penn.
Givin Co., Herebt, 30 Church St., N. Y. City.
Harris Bros. Co., Chicago, Ill.
Hobbs, Lewter F., Norfolk, Va.
Houston, J. C., 50 Church St., New York City.
Knapp Mchy. & Supply Co., 120 Liberty St., N. Y. C.
Lines-Flynn Co., 30 Church St., New York City.
Marine Metal & Supply Co., 167 South St., N.Y. C.
Moore Bros., New York Life Bldg., Chicago, Ill.
New York Purchasing Agency, Inc., 76 Pine St., New York City.
Pipe & Contractors Supply Co., 3 Dover St., New York City.
Sampson Co., George H., 13 Pearl St., Boston, Mass., and 32 Broadway, New York City.
Seyfert's Sons, Inc., L. F., 437 N. Third St., Philadelphia, Penn.
Titan Equipment Co., 30 Church St., N. Y. City.
Williams, Brown & Earle, 918 Chestnut St., Philadelphia, Penn.
Zelnicker Supply Co., Walter A., St. Louis, Mo.

Sewage System Ejector
Blackburn Smith Corp., New York City.

Sewer Pipe, Segmental
Robinson Clay Products Co., The, Akron, Ohio.

Sharpening Machines (Drill Bit)
Ingersoll-Rand Co., 11 Broadway, New York City.
Sullivan Mach. Co., 122 S. Mich. Ave., Chicago.

Shovels, Power
Ball Engine Co., Erie, Penn.
"Erie Steam and Electric Revolving Shovels."
Erie Steam Shovel Co., Erie, Penn.
Marion Steam Shovel Co., Station M, Marion, O.
Cable: Barnhart. Branches: Atlanta, Chicago, New York, San Francisco, Seattle.
All standard sizes and capacities.
Electric, steam or gasoline power equipment.
Thew Automatic Shovel Co., Lorain, Ohio.

Shutters, Steel and Wood Rolling
Kinnear Mfg. Co., Columbus, Ohio.

Sidewalk Forms
Blaw Steel Construction Co., Pittsburgh, Penn.

Siphous Flush Tank
Pacific Flush Tank Co., Chicago, Ill.

Skips
Insley Mfg. Co., Indianapolis, Ind.
Drouve Co., The G., Bridgeport, Conn.

Sluice Gates
Chapman Valve Co., Indian Orchard, Mass.
Coldwell-Wilcox Co., Newburgh, N. Y.

Softeners, Water
N. Y. Continental Jewell Filtration Co., New York.
Roberts Filter Mfg. Co., Darby, Penn.

Spreaders, Ballast
Jordan Co., O. F., Chicago and Kennedy Aves., East Chicago, Ind.

Stacks, Steel
Chicago Bridge & Iron Works, Chicago, Ill.
Pittsburgh-Des Moines Steel Co., Pittsburgh, Pa.
Riter-Conley Co., Pittsburgh, Penn.

Standpipes
Chicago Bridge & Iron Works, Chicago, Ill.
Pittsburgh-Des Moines Steel Co., Pittsburgh, Pa.
Struthers-Wells Co., Warren, Penn. N. Y. City.
Tippett & Wood, Phillipsburg, N. J.
Walsh's Holyoke Steam Boiler Wks., Holyoke, Mass.

Steam Pipe Covering
Michigan Pipe Co., Bay City, Mich.

Steel (Plates and Bars)
American Pressed Steel Co., Philadelphia, Penn.
Carnegie Steel Co., Pittsburgh, Penn.
Open hearth, Bessemer and alloy steels.
Lackawanna Steel Co., Lackawanna, N. Y.
Branches: New York, Boston, Buffalo, Philadelphia, Cleveland, Cincinnati, Chicago, Detroit, St. Louis, Atlanta, San Francisco.
Sheared and universal plates, sheet bars, merchant bars in rounds, squares, flats, ovals, half ovals and hexagons.

Steel Plate Construction
American Bridge Co., 30 Church St., N. Y. City.
Bethlehem Steel Bridge Co., South Bethlehem, Pa.
Blaw Steel Construction Co., Pittsburgh, Penn.
Chicago Bridge & Iron Wks., Chicago, Ill.
Coatsville Boiler Works, New York City.
Earl C. Maxwell Co., Brooklyn, New York.
Pittsburgh-Des Moines Steel Co., Pittsburgh, Pa.
Riter-Conley Co., Pittsburgh, Penn.
Struthers-Wells Co., Warren, Penn.
Tippett & Wood, Phillipsburg, N. J.
Walsh's Holyoke Steam Boiler Wks., Holyoke, Mass.
Williams Co., G. H., Cleveland, Ohio.

Steel, Structural
American Bridge Co., 30 Church St., New York.
Berlin Construction Co., Berlin, Conn.
Blaw Steel Construction Co., Pittsburgh, Penn.
165 Broadway, N. Y. City. Peoples Gas Bldg., Chicago.
Buffalo Steel Co., Tonawanda, N. Y.
Carnegie Steel Co., Pittsburgh, Penn.
Beams, channels, angles and structural shapes.
Case Crane & Engineering Co., Columbus, Ohio.
Chicago Bridge & Iron Wks., Chicago, Ill.
Eastern Bridge & Structural Co., Worcester, Mass.
Fort Pitt Bridge Works, Pittsburgh, Penn.
Kenwood Bridge Co., Chicago, Ill.
King Bridge Co., Cleveland, Ohio.
Lackawanna Bridge Co., New York.
Lackawanna Steel Co., Lackawanna, N. Y.
Branches: New York, Boston, Buffalo, Philadelphia, Cleveland, Cincinnati, Chicago, Detroit, St. Louis, Atlanta, San Francisco.
Standard structural beams, angles and channels.
MacKinnon-Holmes & Co., Sherbrooke, Que., Can.
Earl C. Maxwell Co., Brooklyn, New York.
McClintic-Marshall Co., Pittsburgh, Penn.
Milwaukee Bridge Co., Milwaukee, Wis.
Minneapolis Steel & Machry. Co., Minneapolis.
Mount Vernon Bridge Co., Mt. Vernon, Ohio.
Penn Bridge Co., Beaver Falls, Penn.
Phoenix Bridge Co., Phoenixville, Penn.
Pittsburgh-Des Moines Steel Co., Pittsburgh, Pa.
Riter-Conley Co., Pittsburgh, Penn.
Riverside Bridge Co., Martins Ferry, Ohio.
Shoemaker & Co., Lewis F., Pottstown, Penn.

Erie Revolving Shovels

"How's The ERIE for Shallow STREET WORK?"

Bill Muldoon says:

"Some of my contracting friends put it up to me just like that—but they only ask it once. How's the ERIE on shallow cuts?

"Then I show them what the Erie has done and *is doing* on shallow street grading for Lennane in Detroit, for Blakeslee in New Haven, Moerllering in Ft. Wayne, and many others I know.

"On Blakeslee's job in New Haven, for instance, I found an Erie working in two-foot cut, loading 38 three-horse teams an hour (3 cu.yd. loads).

"On another job, digging 2½ ft. of hard telford paving 40 ft. wide at the rate of ¾ mile a month.

"Lennane, of Detroit, had his second ERIE SHOVEL on a shallow street grading job and was leaving a fine, clean finished grade behind it.

"The Erie's a quick-acting shovel—that's one reason for her big output in shallow cuts. The automatic-crowding device gives the level floor and cuts finishing costs.

"If you haven't time to look her up 'on the job' just ask for 'Facts—Figures and Photos.'

It Shows the Erie at Work"

Bill Muldoon.

BALL ENGINE CO.

ERIE PA

Snare & Triest Co., Woolworth Bldg., N. Y. C
Strauss Bascule Bridge Co., Chicago, Ill.

Stokers
Babcock & Wilcox Co., The, 85 Liberty St., New York City. Works: Barberton, Ohio. Branch offices in principal cities.

Stop Crack Fasteners
Janney & Steinmetz Co., Philadelphia, Penn.

Strainers, Well
Cook, A. D., Lawrenceburg, Ind.

Superheaters, Steam and Air
Power Specialty Co., 111 Bway., N. Y. Br.: Boston, Phila., Pittsburgh, Chicago, San Francisco.

Switch Stands
Bethlehem Steel Co., South Bethlehem, Penn.

Tables and Boards, Drawing
Dietzgen Co., Eugene, Chicago, Ill.
Keuffel & Esser Co., New York. Hoboken, N. J.
Weber & Co., F., Philadelphia, Penn.

Tanks, Automatic Sprinkler
Pittsburgh-Des Moines Steel Co., Pittsburgh, Pa.
Ritchie & Sons, E. G., 112 Cypress St., Brookline, Mass.

Tanks, Concrete
Concrete Steel Co., 42 Broadway, New York City.

Tanks and Towers
American Bridge Co., 30 Church St., N. Y. City.
Blaw Steel Construction Co., Pittsburgh, Penn.
Chicago Bridge & Iron Wks., Chicago, Ill.
Coatsville Boiler Works, New York City.
Pittsburgh-Des Moines Steel Co., Pitsburgh, Penn.
Riter-Conley Co., Pittsburgh, Penn.
Struthers-Wells Co., Warren, Penn.
Tippett & Wood, Phillipsburg, N. J.
Walsh's Holyoke Steam Boiler Wks., Holyoke, Mass.

Tank, Septic
U. S. Sanitary Septic Tank Co., Exchange Bldg., Memphis, Tenn.

Tanks, Wood
Pacific Coast Pipe Co., Seattle, Wash.
Pacific Tank & Pipe Co., 306 Market St., San Francisco, Calif.
Portland Wood Pipe Co., Portland, Ore.
Redwood Manufacturers Co., 1605 Hobart Bldg., San Francisco, Calif.
Washington Pipe & Foundry Co., 1512-1620 Center St. and 3001-3019 Asotin St., Tacoma, Wash. Cable: Wash Pipe.

Tapes, Steel and Metallic
Chicago Steel Tape Co., Chicago, Ill.
Dietzgen Co., Eugene, Chicago, Ill.
Keuffel & Esser Co., New York. Hoboken, N. J.
Kolesch & Co., 138 Fulton St., New York City.
Lufkin Rule Co., Saginaw, Mich. N. Y. City

Test Boring
Sullivan Mach. Co., 122 S. Mich. Ave., Chicago.

Thermometers
Taylor Instrument Co., Rochester, N. Y.

Thermometers, Recording
Taylor Instrument Co., Rochester, N. Y.

Ties, Steel
American Bridge Co., 30 Church St., N. Y. City.
Jennison-Wright Co., 320 Huron St., Toledo, O.

Tile, Concrete Building
U. S. Gypsum Co., Chicago, Ill.

Timber (Treated)
Berlin Mills Co., Portland, Maine.
Eppinger & Russell Co., 165 Broadway, New York.
Jennison-Wright Co., 320 Huron St., Toledo, Ohio.

Ties, Treated
Jennison-Wright Co., 2462 Broadway, Toledo, Ohio.

Ties, Treated Wood
Berlin Mills Co., The, Portland, Maine.

Timber, Treated
Jennison-Wright Co., 2462 Broadway, Toledo, Ohio.

Tires, Truck
Goodrich Co., B. F., Akron, Ohio.

Tools, Pneumatic
Chicago Pneumatic Tool Co., Chicago, Ill.
Pneumatic riveting, chipping and caulking.
Ingersoll-Rand Co., 11 Broadway, New York City.

Tools, Steel
Bethlehem Steel Co., South Bethlehem, Penn.

Tracing Cloth
Defiance Mfg. Co., 22 E. 41st St., N. Y. City.
National Tracing Cloth Co., Saylesville, R. I.
Robbins Co., Chas. H., 125 S. 11th St., Phila., Pa.

Track, Industrial and Portable
Easton Car & Construction Co., Easton, Penn.

Tramways
American Steel & Wire Co., Chicago, Ill.
Waterbury Co., The, 63 Park Row, New York.

Transformers, Electric
General Electric Co., Schenectady, N. Y.

Transits and Levels
Kolesch & Co., 138 Fulton St., New York City.

Transmission Towers, Galvanized
American Bridge Co., 30 Church St., New York.
Blaw Steel Construction Co., Pittsburgh, Penn.
Riter-Conley Co., Pittsburgh, Penn.

Treads, Safety
Concrete Steel Co., 42 Broadway, New York City.

Trenching Machinery
Austin Drainage Excavator Co., F. C., Railway Exchange Bldg., Chicago, Ill.
Ball Engine Co., Erie, Penn.
Carson Trench Mach. Co., Boston, Mass.
Marion Steam Shovel Co., Station M, Marion, O.
Municipal Engineering & Cont. Co., Chicago, Ill.
Parsons Co., G. W., Newton, Iowa.
Thew Automatic Shovel Co., Lorain, Ohio.

Trolleys, I-Beam
Brown Hoisting Machy. Co., Cleveland, Ohio.

Turbines, Hydraulic
Smith, S. Morgan, York, Penn
General Electric Co., Schenectady, N. Y.

Turbines, Steam
Alberger Pump & Condenser Co., New York City.
De Laval Steam Turbine Co., Trenton, N. J.
One to 15,000 hp. All services.
General Electric Co., Schenectady, N. Y.
Leffel & Co., James, Springfield, Ohio.

Turbines, Water
Pelton Water Wheel Co., San Francisco, Calif.

Turnbuckles
American Bridge Co., 30 Church St., New York.

Turntables
American Bridge Co., 30 Church St., New York.
Bethlehem Steel Bridge Co., South Bethlehem, Pa.
Whiting Foundry Equipment Co., Harvey, Ill.

Turpentine
Berlin Mills Co., Portland, Maine.

Underpinning
Foundation Co., The, Woolworth Bldg., N. Y. City.
Smith, Hauser & MacIsaac, Inc., 18 East 41st St., New York City.
Underpinning & Foundation Co., 290 Bway., N. Y.

Valves, Altitude
Chapman Valve Co., Indian Orchard, Mass.
Golden Anderson Valve Specialty Co., Pittsburgh, Penn.
Simplex Valve & Meter Co., 112 N. Broad St., Philadelphia, Penn.

Valves, Automatic Air
Chapman Valve Co., Indian Orchard, Mass.
Simplex Valve & Meter Co., 112 N. Broad St., Philadelphia, Penn.

Valves, Automatic Sprinkler
Kennedy Valve Mfg. Co., Elmira, N. Y.

Valves, Suction
Chapman Valve Co., Indian Orchard, Mass.

Valves, Water, Steam, Gas
Chapman Valve Co., Indian Orchard, Mass.
Coldwell-Wilcox Co., Newburgh, N. Y.
Darling Pump & Mfg. Co., Williamsport, Penn.
Eddy Valve Co., Waterford, N. Y.
Golden-Anderson Valve Specialty Co., 1202 Fulton Bldg., Pittsburgh, Penn.
uniform water level in tanks, etc. "Water Regulating"—control a reduced pressure regardless of initial volume. "Triple Acting Non-Return"—for automatically protecting boilers and steam lines. "Float Valves" for maintaining water.
Kennedy Valve Mfg. Co., Elmira, N. Y.
Norwood Engrg. Co., Florence, Mass.
Smith Mfg. Co., The A P, East Orange, N J
Wood & Co., R. D., 409 Chestnut St., Phila., Pa.

Ventilating Apparatus
David Luptons Sons Co., Philadelphia, Penn.
Ohio Blower Co., 5133 Perkins Ave., Cleveland, O.

Wagon Loadings
Geo. Haiss Mfg. Co., 142d St. & Ryder Ave., N. Y. C.

Wagons, Dump
Austin Mfg. Co., Chicago, Ill.
Austin-Western Road Mchry. Co., Chicago, Ill.
Western Wheeled Scraper Co., Aurora, Ill.

Water Main Cleaning
National Water Main Cleaning Co., New York City.

Waterproofing
Anti-Hydro Waterproofing Co., 170 Washington St., Newark, N. J.
Barret Company, The, New York City.
Masonry Waterproofing Co., Brooklyn, N. Y.
Carey Co., Philip, 18 Wayne Ave., Lockland, Ohio.
Protective Material Corp., 51 E. 42nd St., N. Y. C.
Toch Bros., N. Y. City. Branches: Toronto, Canada; London, England.
Trus-Con Laboratories Co., Detroit, Mich.

Water Wheels
Pelton Water Wheel Co., San Francisco, Calif.
Smith, S. Morgan, York, Penn.

Welding Apparatus
General Electric Co., Schenectady, N. Y.

Welding and Welding Machines
Goldschmidt Thermit Co., 120 Bway., N. Y. City.
Prest-O-Lite Co., Inc., Indianapolis, Ind.

Well Drillers
Phillips & Worthington, 90 West St., N. Y. City.

Well Drilling Machines
American Well Works, The, Aurora, Ill.
Keystone Driller Co., Beaver Falls, Penn.

Winches
Brown Hoisting Machy. Co., Cleveland, Ohio.
Lidgerwood Mfg. Co., 96 Liberty St., N. Y. City.

Window Sash, Steel
David Luptons Sons Co., Philadelphia, Penn.
Trussed Concrete Steel Co., Dept. 12, Youngstown, Ohio.
Representatives in principal cities.
"United" steel sash; horizontally and vertically pivoted sash. Counterbalanced and counterweighted sliding sash. Center pivoted and top hung continuous sash. Steel and glass partitions, sliding and swing doors. Casement sash.

Wire Glass
Mississippi Wire Glass Co., 218 Fifth Ave., New York City.
Wire glass for fireproof constructions. Clear, frosted, patterned and special light transmitting. Sample, report on light diffusion and general catalog on request.

Wood Blocks, Paving
Jennison-Wright Co., 2462 Broadway, Toledo, Ohio.

Wood Casings
Michigan Pipe Co., Bay City, Mich.

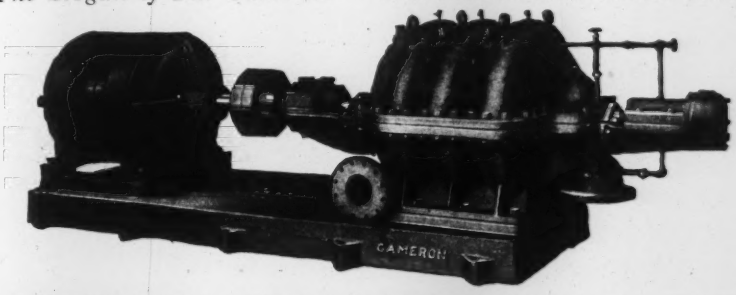
Wood Pipe
Michigan Pipe Co., Bay City, Mich.

Wood Preserving
American Creosoting Co., 17 Battery Pl., N. Y. C.
Barrett Company, The, New York City.
Carbolineum Wood Preserving Co., 181 Franklin St., New York City, N. Y.
International Creosoting & Construction Co., Galveston, Tex.
Protective Material Corp., 51 E. 42nd St., N. Y. C.

Wrenches
Greene, Tweed & Co., 108 Duane St., N. Y. City.
"Reversible socket wrenches."

If you are using anything in your work which you do not find listed in this Buyers Cyclopedia, we would appreciate your writing about it.

The Slogan of The Cameron—"Character: The Grandest Thing"



CAMERON CENTRIFUGAL PUMPS

Engineers have found that the sure way to secure pump efficiency and economy is to install Cameron Centrifugal Pumps.

Actual working tests have proved that these pumps produce the highest working value at the lowest operating cost. They have been notably successful in all kinds of contracting work.

All the experience gained during half a century in pump building is back of the design and manufacture of these Cameron Centrifugals.

They are unusually simple in design and compact in construction. The horizontally split casing gives quick access to the working parts without disturbing pipe connections or pump alignment.

The illustration above shows one type of Cameron Centrifugal. It is a 6-in. four-stage pump, with a capacity of 1000 gallons a minute against 500 ft. head at 1165 R.P.M.

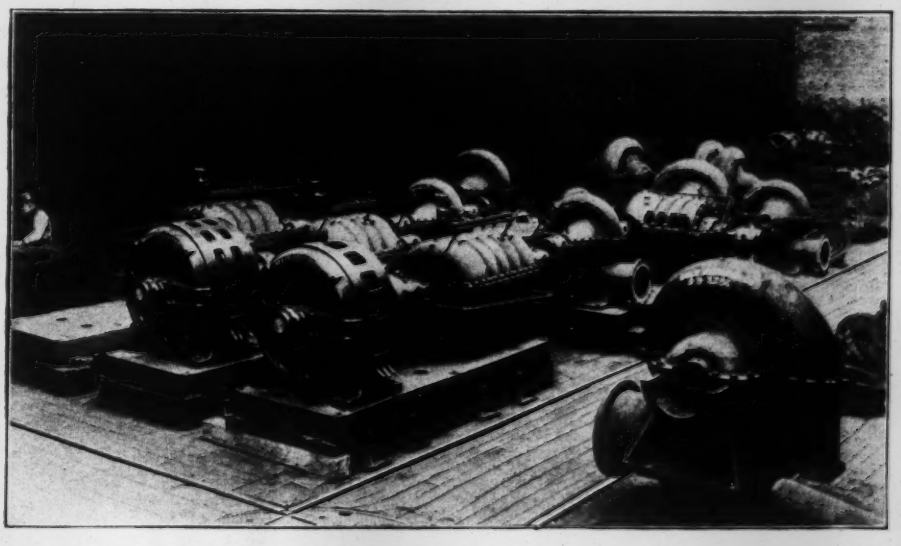
Cameron Centrifugals are built in many types and sizes for various classes of work. Our Engineering Department will be glad to figure on your requirements.

Write now for Bulletin No. 151. *It's free.*

A. S. CAMERON STEAM PUMP WORKS

11 Broadway, New York **Offices the World Over**

These Are Some Types of Centrifugal Pumps Which We Build



The multi-stage pumps in front at the left are for mine service—and the single stage-pump at the right is for irrigating—further back there is a large multi-stage boiler feed pump and some standard single-stage pumps for general service.

We would like to send you our bulletin No. 1632-A describing these and other types as it contains valuable information for all prospective users of centrifugal pumps.

ALLIS-CHALMERS MANUFACTURING COMPANY

MILWAUKEE - - - WISCONSIN

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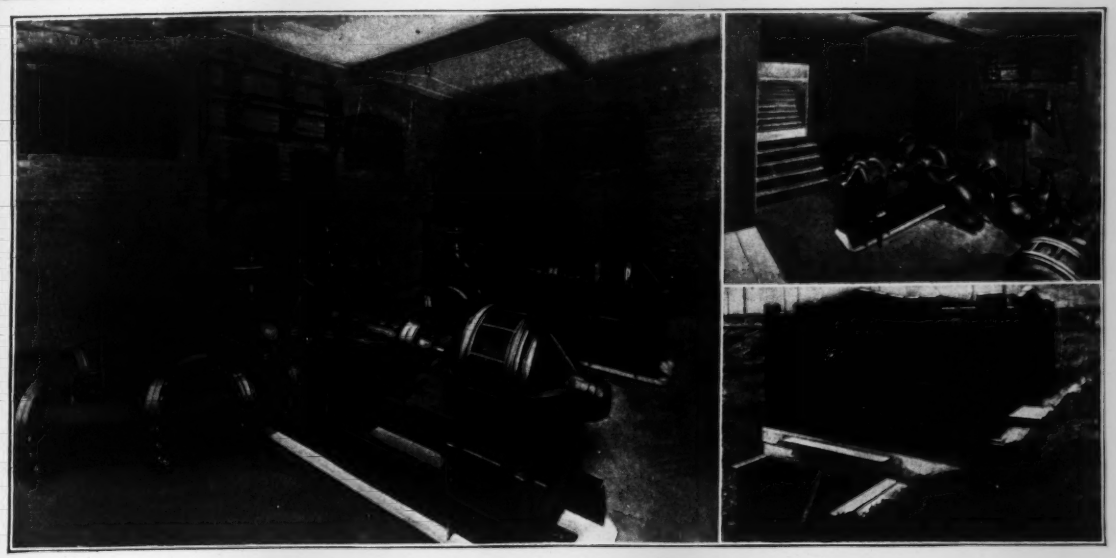
AMERICAN



Regulating the Ground-Water Level with Drainage Pumps

The North Kansas City Levee Drainage District comprises about 2,400 acres and is protected from high water of the Missouri River by dikes or levees 14 feet or more in height.

During ordinary stages of the river all rainfall in the District soaks into the sandy soil and disappears in a short time, but during high water in the river, the ground is saturated with water to within a short distance of the surface and heavy rainfalls must be taken care of by pumping.

For the removal of this excess water a system of drainage ditches were constructed, having a fall of about 9 feet in two miles. These ditches carry the rain water and whatever seepage occurs direct to the pumping station.

The pumps are installed in a brick pump station, with a reinforced concrete pump pit or basin excavated out of solid rock. Water is pumped through a concrete culvert leading through the levee or drainage district dike and runs into the river.

For the pumping equipment we furnished two "American" 15-inch double suction, horizontal, split-shell type, centrifugal pumps directly coupled to 35-horsepower, 3-phase, 25-cycle, 220-volt General Electric motors. Each of these pumps is designed to deliver 5,000 g.p.m. against a total head of 18 feet when operating at 480 r.p.m.

We also supplied an "American" 8-inch vertical type centrifugal pump direct connected to vertical 15-h.p., 3-phase, 25-cycle, 220-volt motor, designed to deliver 2,000 g.p.m. at a total head of 20 feet when operating at 715 r.p.m.

The accompanying illustrations show two interior views of the pumping station, also an exterior view of the pump house. Note the steel frames to the pumps and the high grade of construction used in this installation.

These pumps have been installed about one year, and while the water in the river has not been sufficiently high since their installation to test their capacity, they have quickly removed all excess water of spring rains from the drainage district.

This is only an example of the type of "American" centrifugal pumps which are being extensively installed for drainage pumping throughout the upper Mississippi Valley.

"American" centrifugal pumps are described in catalogue 132. Write for it.

The American Well Works

General Office and Works: Aurora, Illinois, U. S. A.
Chicago Office: First National Bank Building

District Sales Agencies

New York City (Domestic and Export
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Joplin, Mo.
St. Louis, Mo.
Calgary, Alta.

Upper illustration shows method of charging and unloading treating-tank

Lower illustration shows a temporary open treating-tank, constructed of wood lined with galvanized sheet iron, soldered at all joints; size 20 ft. x 25 ft. x 3 ft. deep. Note steam pipes for heating.

Wood Preservation is always available by using the Open-Tank System

THE Open-Tank System of creosoting wood is not a substitute for any other process, nor is it a makeshift. Within its limitations, it is the *best method.*

It is particularly suitable for the preservative treatment of *all* structural wood which, when in place, *is not subject to severe mechanical abrasion.*

It is adaptable to all conditions, is economical and effective.

The cost is reasonable and warranted in each case where the mechanical life of the structure is greater than the natural life of the wood.

The illustrations herewith show a temporary plant, and its operation during the treatment of over one-quarter million feet, board measure, of 12x12 inch and 6x12 inch timbers, used as floor-framing in an industrial building in which conditions are favorable to the development of decay.

An average absorption was obtained of approximately 10 gallons of CARBOSOTA Creosote Oil per 100 square feet of surface.

The theory of the Open-Tank System is that in the hot treatment the heat of the preservative expands and expels a portion of the air and water contained in the wood-cells. Then upon immersion in the cold oil, or when subjected to the change in temperature caused by the cooling of the creosote, there is a partial contraction and condensation of the air and water that remains, resulting in a slight vacuum within the wood. This, aided by atmospheric pressure combined with capillary action between the wood-cells and the preservative, achieves the actual impregnation.

Barrett's CARBOSOTA—*Grade-One Liquid Creosote Oil* is derived from pure coal tar, and refined especially for the Brush Method and the Open-Tank System of treatment. It meets all official specifications, and is recognized as the Universal Standard by all authorities. Write for helpful booklet, "Long Life for Wood."

The Barrett Company

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